

Onsala Steering Committee

22nd May 2026

Version 2

John Conway & Vincent Desmaris

Agenda

09:00 Meeting Start

- | | | |
|--|-------------|-------|
| 1. Adoption of the agenda | 09:00-09:05 | Chair |
| 2. Minutes/actions of previous meeting | 09:35-09:10 | Chair |
| 3. Observatory News | 09:10-10:10 | |
| 3.1 New infrastructure host department of Physics and Astronomy from 1 st April | | JC |
| 3.2 Summary of staff status (organogram), arrival/departures, staff survey | | VD |
| 3.3 Workshop completion and Rymdrum visitor centre exhibition upgrade | | VD |
| 3.4 GARD ALMA receiver developments+ ESA LETO mission | | VD |
| 3.5 Triband receiver for 20m telescope - project status. | | JC |
| 3.6 Future fundraising ideas - i.e.- replacement antenna for 25m, space involvement | | JC |
| 3.7 Plans/status for new infrastructure recruitments | | JC |
| 3.8 LOFAR 2.0 upgrade and LOFAR ERIC | | JC |
| 3.9 JIV-ERIC, Consolidation of European Radio Astronomy | | JC |
| 3.10 EU proposals with deadline 15 th June | | JC |
| 3.11 SKA status including SRC node | | JC |
| 3.12 Annual report to VR including user/publication statistics | | JC |
| 3.13 Recent science results | | JC |

- | | | |
|--|---------------|----|
| 4. VR proposal 2027-2020 final outcome | 10:10 – 10:30 | JC |
| 5. OSO Risk register | 10:30 – 11:00 | JC |
| 6. Geo activities | 11:00 – 12:00 | RH |

Lunch Break

12:00 - 12:45

- | | | |
|--|----------------|-------|
| 7. New OSO Director recruitment and job advert (closed session) | 12:45 – 13:30. | Chair |
| 8. Budget result 2025. | 13:30 – 13:50. | JC |
| 9. Budget prognosis 2026 | 13:50 – 14:00 | JC |
| 10. Capital, Long term financial prognosis. 2027 budget preparation | 14:00 – 14:30 | JC |
| 11. AOB/Next meeting | 14:30 - 15:00 | JC |

15:00 Meeting End

2. Minutes and Action Items from last meeting

2025-1-AI3 continued: --- JC to share the video from PEO related to Geo activities

>> Put in teams area for OSC meeting 25-05-16 as described to OSC members in email of 25-11-05

2025-1-AI7 continued: ---- On JES to convene a small Group to discuss future OSO strategy - JES not yet done while waiting on VR result. JES to work on this after VR result. >> Net yet done – keep action or defer for now?

2025-2-A1: --- JC, WV, VD will send the slides for the hearing to the OSC by Wednesday October 22nd for feedback by Thursday October 24th

>> Draft slides for dialogue meeting were sent 21st October 2025 and feedback incorporated

2025-2-A2: ---- JC + RuH to work on a strategy leveraging LM and Chalmers to co-invest in the geo activities

>> A meeting was held 9th January including John, Rudiger, Daniella, Per Erik, Jan-Eric, Lars Börjesson and Martin Lidberg (from Lantmäteriet) discussed strategy for arranging a visit to Chalmers and OSO by LM Director (now arranged for 3rd September)

2025-2-A3: ----JC will report at the next two OSC meetings an eventual decision on contributing to the Geo-hut investment (supporting atmospheric spectroscopy) and its depreciation.

>> No time yet to work on this but will be addressed part of the decision at the next OSC to approve the 2027 budget in its next meeting in October

2025-2-A4: --- JC to establish an updated long-term budget forecast to be shared after the level of VR funding is known, to then be re-discussed with the OSC -

-- Final VR result came much later than expected, a revised forecast (with remaining uncertainties) is presented later in this meeting

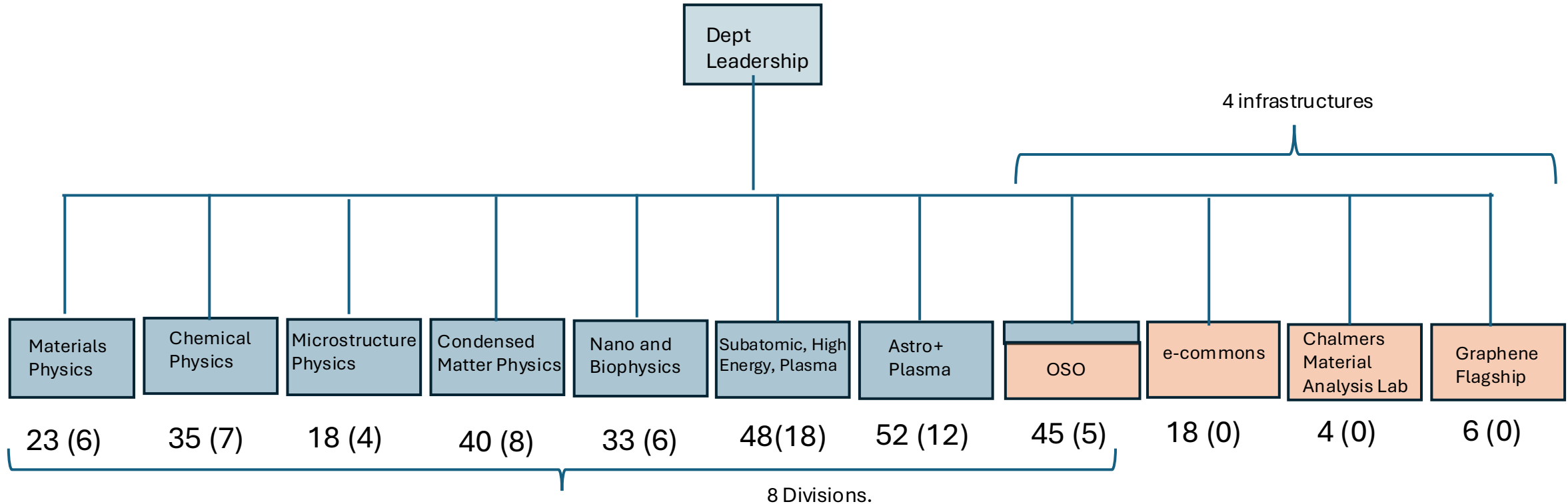
2025-2-A5: JES to approach LB to involve the Chalmers Rektor in a meeting with the new general director of LM. - Now arranged for 3rd September

2025-2-A6: JC send a doodle for the next OSC meeting – Was done

2025-2-A7: JC reports to the OSC after the VR hearing on October 29th. - a short note on that meeting sent by JC to OSC on 30th October followed by the VR minutes of that meeting when received from VR on 28th November. A second dialogue meeting was held 11th December with update sent to OSC member 19th December. A Chalmers reply to a request from VR for additional information was sent to VR on 25th January. The OSC was informed of the final funding result amount on 4th March,

3. Observatory News

3.1 New infrastructure host department of Physics and Astronomy



Numbers are, **estimated by quickly inspecting staff webpages**, the total none-adjunct/emeritus/visitor staff including Postdocs/Students. Brackets give base-financed faculty

- Came into being 1st April 2026 as merger of existing Physics Dept and the OSO and AoP divisions from the terminated SEE department
- Chalmers now has 13 Departments. Physics and Astronomy is one of largest (with Chemistry)
- Smooth transition but still learning some cultural differences
- OSO unique in being both a Division and an Infrastructure – with both a Division Head and Director (who will be called to Manager meetings but not Dept leadership group, where Vincent represents OSO Division)
- Still TBD is ‘Faculty Model’ i.e. how much of faculty funding Dept gets filters down to Divisions and individual faculty members.
- Some Chalmers-wide changes ongoing in job titles at same time as forming new reorganization

3.2 OSO Personnel news

Left/leaving:

TSG: [Magnus Dahlgren](#) leaves OSO for Omnisys AB at the summer break.

OSO: [Katarina Norheim](#) leaves OSO for the new ENV department.

OSO: [Wouter Vlemmings](#) stepped down from his role of vice-director.

Arrived:

OSO: [Sandra Hainer](#) is our new economy officer for the OSO division, started this month.

OSO: [Peter Forkman](#) returns to Onsala after his tenure as SEE prefekt.

Incoming:

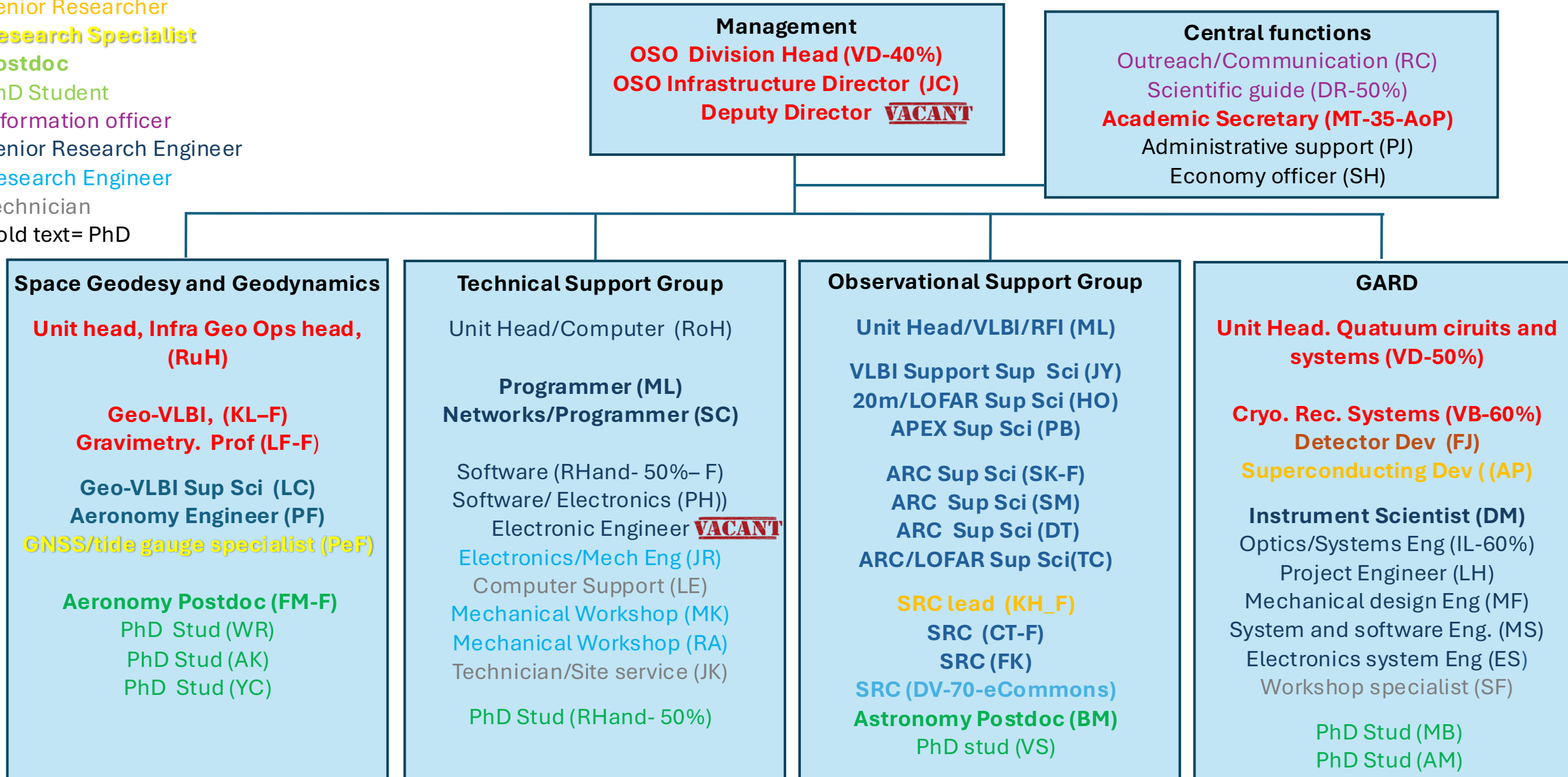
SGG: [Bertrand Lovery](#) new post-doc at working on the Doris system, with tentative start on June 1st.

Advertised positions:

3-4 new positions will be advertised before the summer, pending administrative go-ahead.

3.2 Onsala Space Observatory organogram

Faculty
Assistant Prof-tenure track
Senior Researcher
Research Specialist
Postdoc
PhD Student
Information officer
Senior Research Engineer
Research Engineer
Technician
Bold text= PhD



3.2 Staff Survey Response

Legend:

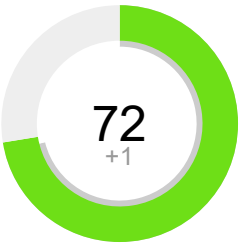
- large numbers: 2026
- Small numbers: changes from 2025

Overall

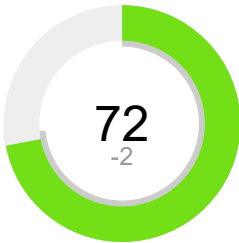
- the response remains positive.

Focus points

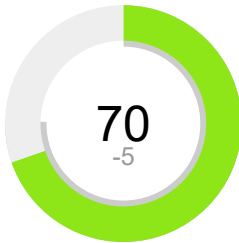
- Drops in objectives, leadership and development and trust
- can be attributed to current restructuration and lengthy decision from VR.



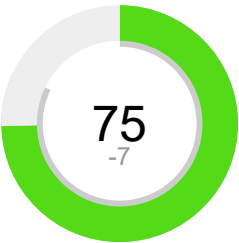
Engagement



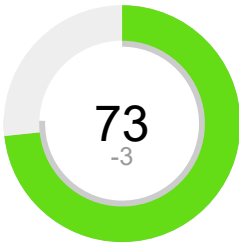
Structure



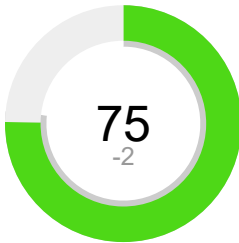
Objectives



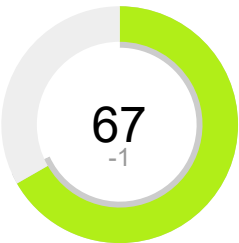
Leadership



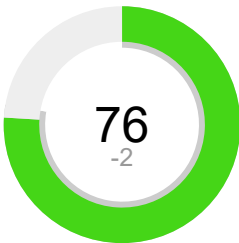
Development



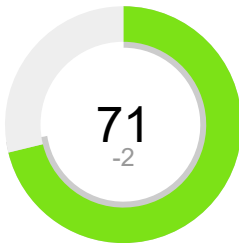
Collaboration



Workload



Trust



Organizational and social work environment

3.3. Admin news – Buildings and premises at the observatory

- **Admin building and 20m: Completed,**
 - Few guaranty adjustments ongoing
- **Workshop: almost Completed,**
 - Minor adjustment to outer paneling on-going
- **Demolition work: start**
 - Few details to be discussed next week
 - Increase circulation on the access road



3.3. Rymdrum/outreach

- Safety upgrade of the wooden ramps
- Planned upgrade of the lighting quality in the building.
- Major upgrade of the visiting center
- Establishment of an outreach strategy for the observatory including usage of the building
- Secured extra funds from Hasselblad



2025 statistics

60 schoolgroups
9 corporate organisations
20 non corp. associations
3 Public events
5 GARD Visits
+2000 people reached

2026 statistics (end of april)

46 school groups
4 corporate org
6 non corp org
3 public events
2 GARD Visits
+1700 people reached



3.4 GARD's ALMA Receivers

ALMA WSU Band 7

- Preparation for bid in Spring/fall 2026
- LOI signed between NOVA (NL), Chalmers (SE) and Yebes (ESP)
- legal preparatory work
 1. export control
 2. foreign investment in Swedish systems

APEX band7 CCA:

Mixer measurements in Test cryostat: Completed

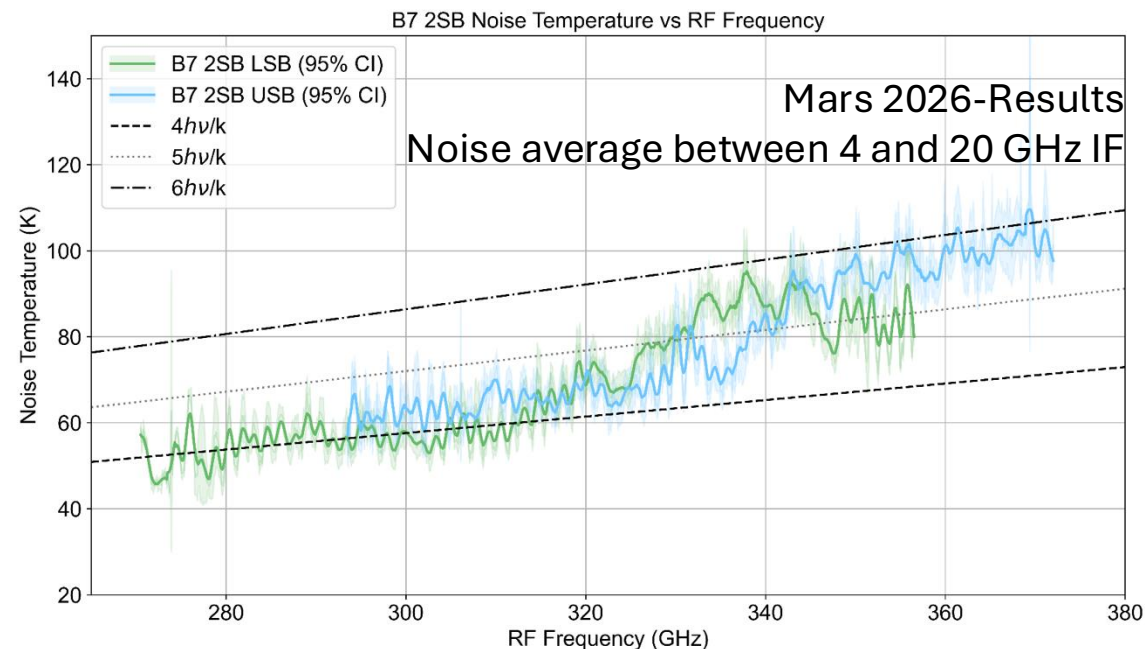
- 2SB tests completed May 2026

CCA measurements in ALMA-compatible cryostat: Ongoing

- Automatic setup for Cartridge receiver beam measurement, completed in March/April 2026
- Automatic noise measurement Setup for setup for Cartridge receiver completed in March/April 2026

CCA assembly and test: Ongoing

- First complete cartridge assembled, May 2026
- First cooling May 2026
- Cartridge tests in coordination with MPI (May/June 2026)
- Install and science verification Summer/fall 2026



3.4 cont -LETO: M-Mission Space Mission

Overall Scientific question: interrelation of stars and the ISM

Specific Mission goals:

1. From Clouds to Stars: the ISM in the Milky Way and in external galaxies
 - A. Galactic Plane and Magellanic Cloud Survey
 - B. From Local Laboratories to Cosmic Benchmarks
2. From stars to planets: Investigating Planet Origins
 - A. Proto-planetary Disk Survey
 - B. Determining Planetary reservoirs – Water and Ammonia

Participation:

GARD: Leading band 2 Receivers based on HEB technology (2 cameras),

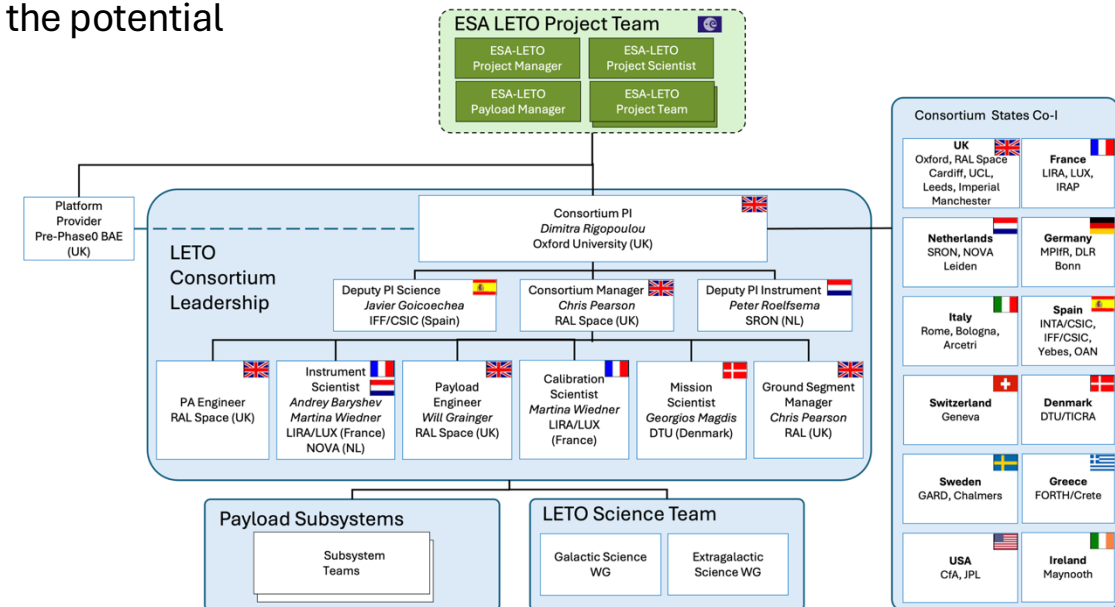
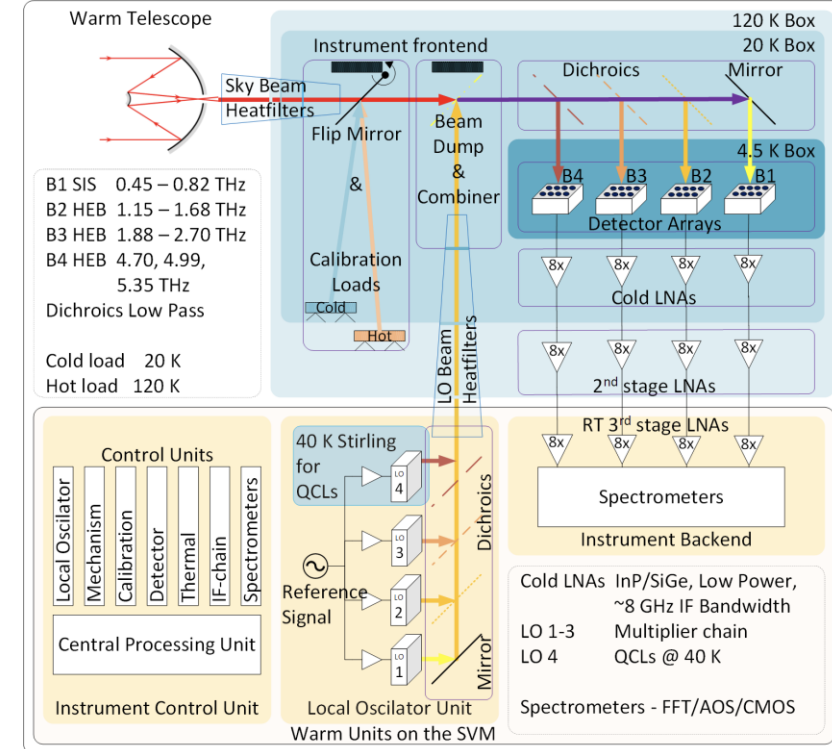
AoP (S. Aalto, E. de Beck, Eva Wirström): Regain of activity and organization of the potential Swedish community.

Status:

- Step-2 proposal submitted by PI to ESA on March 19th 2026,
- Proposal for technical involvement by GARD to SNSA April 20th 2026.
- received a letter of Endorsement from SNSA for activities till launch 2041.

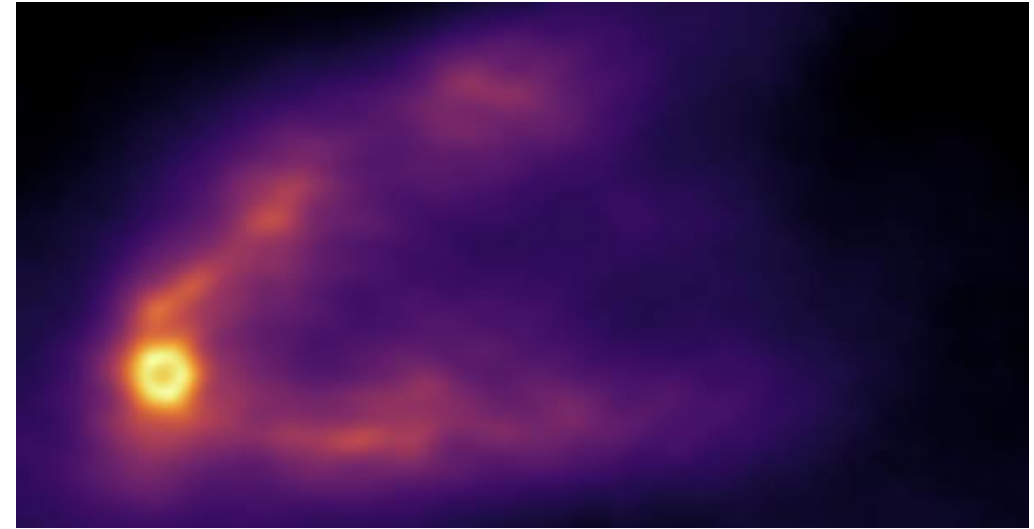
Next Steps:

- Coordinate Swedish effort in LETO (Vincent + Susanne)
- ESA down-selection (from 10 to 5) in Nov 2026 to enter phase 0.



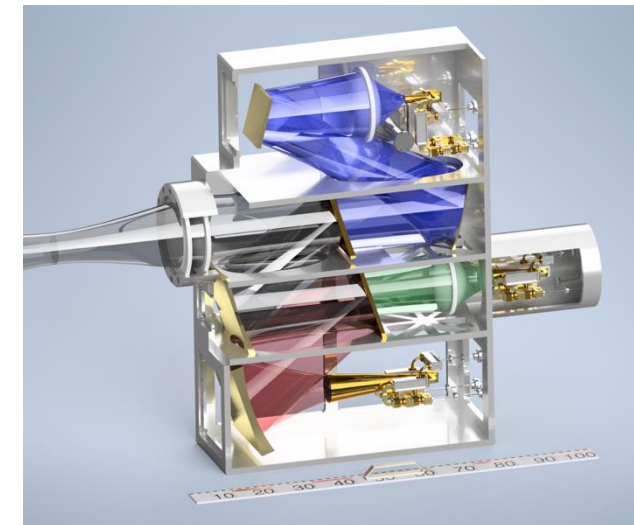
3.5 Triband receiver status

- Got news of 13 Mkr funding from Hasselblad foundation in September (largest single Hasselblad donation ever). Learnt about science this camera can accomplish at yesterdays 50 th anniversary of 20 m telescope
- Triband construction project began 1st January 2026, planned 3 –year duration
- Had observatory internal kick-off meeting Friday 16th January
- First report to Hasselblad 16th February
- Final specifications have been agreed.
- Long lead time components identified and procurement started
- Staff departure (Magnus Dahlgren, TSG) will mean soon a slow down in work until recruitment of two new positions for RF/Optics are recruited (within next 6 months) – during this period some long lead-time components can be delivered.



VLBI image at 3mm wavelength (including 20 m telescope as part of the array) of the M87 black hole and jet launching region (Kim et al 2025)

Schematic diagram of Triband receiver



3.6 Future fundraising ideas – i.e. replacement antenna for 25m



SKA dish, Karoo, South Africa

Produced in China. 15m diameter equivalent dish
Operates 0.3 – 15 (43) GHz. Quotation last year for structure, transport and Installation at Onsala was only 1.3 M€ (does not include foundation or receivers).



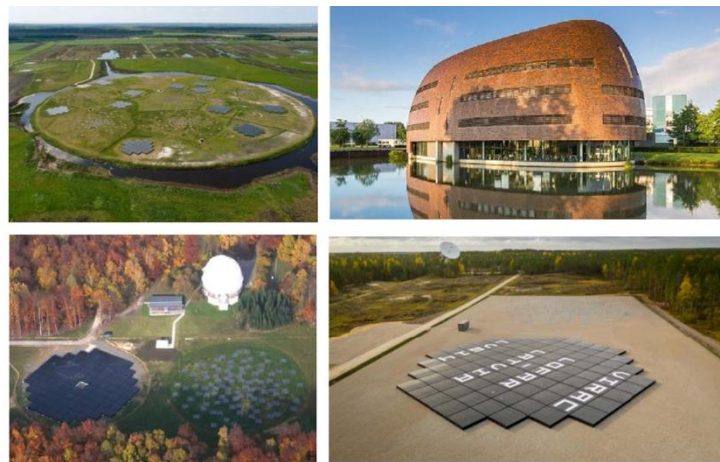
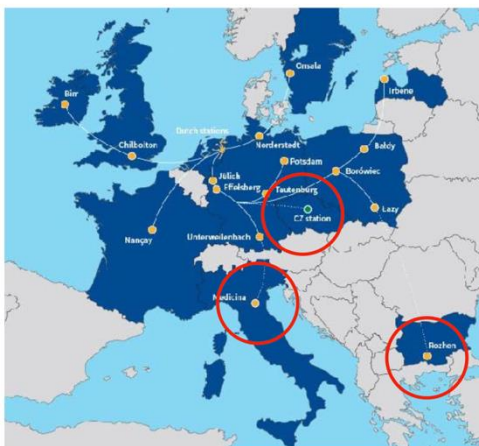
ngVLA dish New Mexico, USA

Produced in Germany. Operates 1.0 – 115 GHz
Structure and installation approx. 4 M€
?? (does not include foundation or receivers)

Fundraising Ideas

- No chance of VR funding in near or mid-term future
- Possibly explore a donation in connection with Chalmers 200th anniversary in 2029 – Initial discussion with Chalmers leader of fundraising; need for compelling narrative
- As well as core astronomy and Geo business emphasize Space connection as a major part of this narrative. i.e. new Masters course, possible goal of Chalmers Student satellite (Rudiger is Chalmers Space coordinator).
- Dish has 50+ year lifetime i.e. till 2076 – **think long-term!**
- Space connections i.e. VLBI of spacecraft (Genesis, JUICE), Space-VLBI (LOVEX), Space Communications (Chalmers probes on Moon??), Space Situational Awareness (bistatic radar imaging of satellites)
- Visit of Swedish Space Agency Science Advisory Committee to Onsala 3rd June.
- Create prospectus for new antenna emphasizing Space applications – need to decide between going for SKA dish or ngVLA dish.

3.8 LOFAR 2.0 upgrade/LOFAR ERIC News



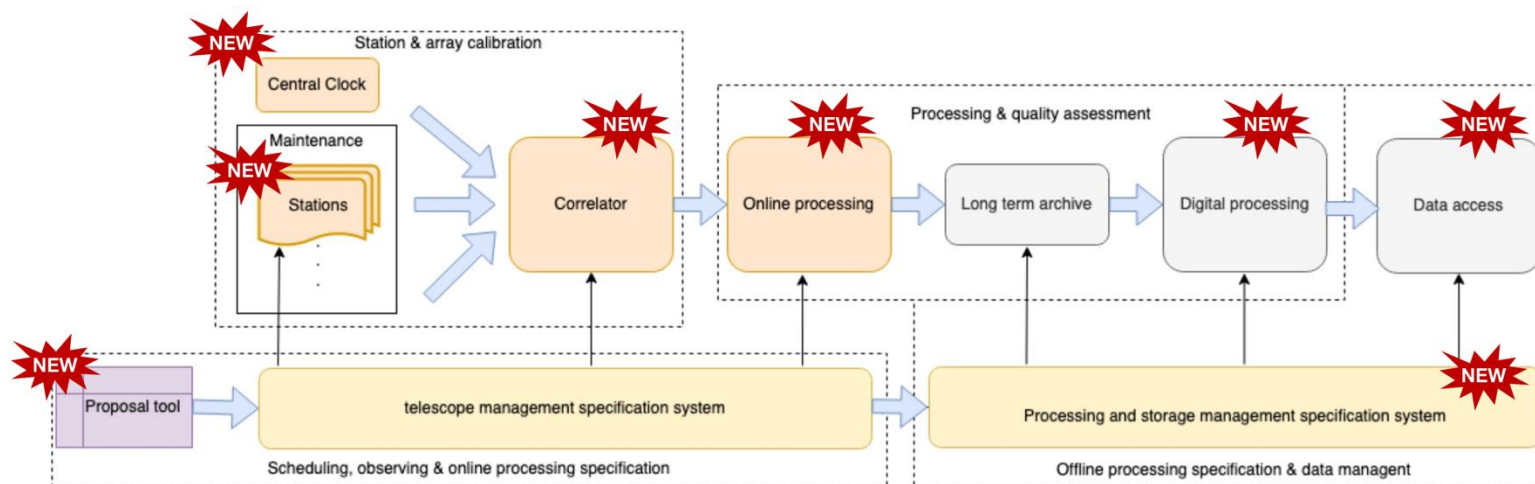
Onsala LOFAR
1.0 station



Onsala LOFAR
2.0 station



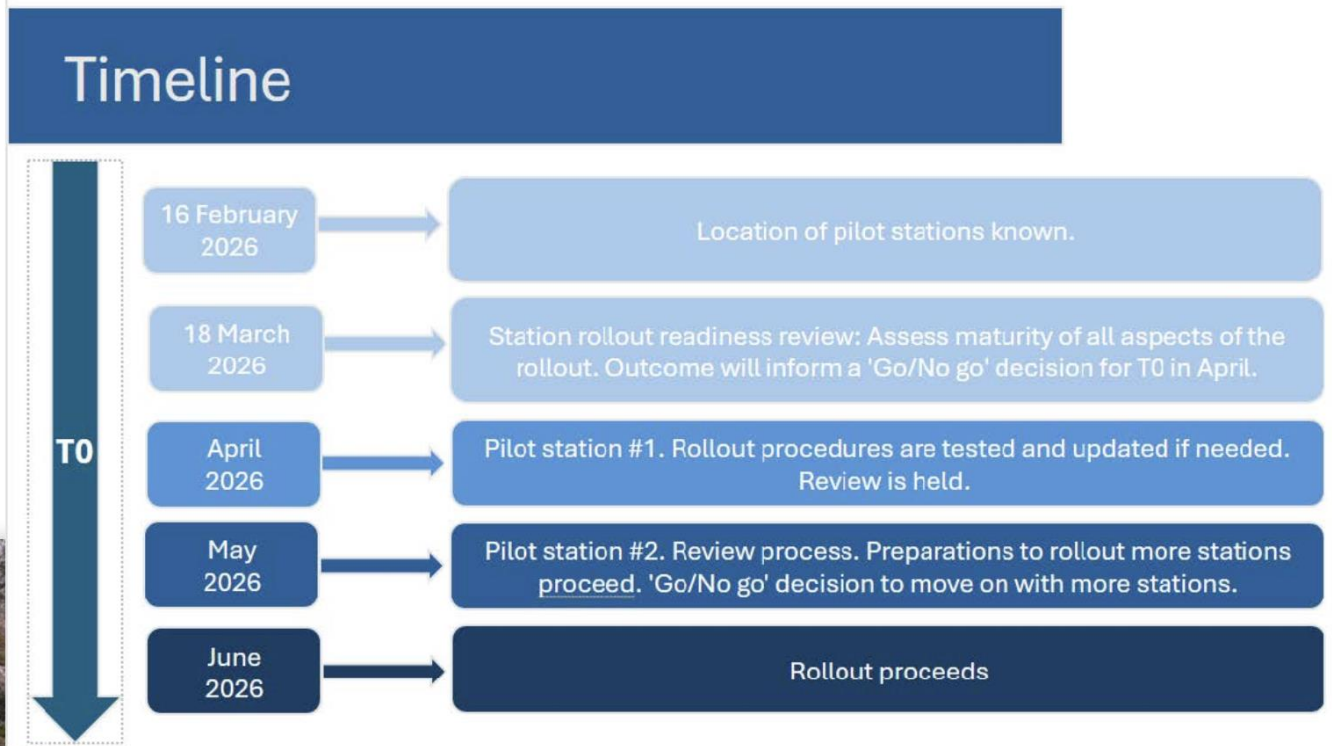
LOFAR array above with three new stations to be constructed (also funding for additional station in Sicily). LOFAR 2.0 station looks the same as LOFAR 1.0 (right figures) but under the hood most things replaced- allows twice bandwidth, simultaneous LBA+HBA more versatility in observing modes. replaces obsolete hardware and and software to maintain lifetime – more emphasis on Europe-wide baseline science and lowest frequencies (both unique in SKA era).



LOFAR 2.0 Upgrade of International Stations

- Roll-Out of International Stations
 - Readiness Review last week
 - upgrade of stations completed in Q1/2 2027

Order	Station	Status	Estimated date
1	SE607	Confirmed	W18
2	PL612	Confirmed	W21
3	PL611	In discussion	W24
4	PL610	In discussion	W26
5	DE609	In discussion	W28



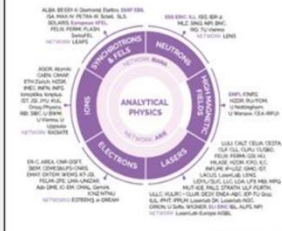
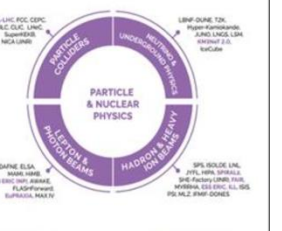
Onsala Upgrade ongoing this week (!)

LOFAR ERIC

- Founder ERIC members Netherlands, Germany, Italy, Ireland, Bulgaria, Poland during 2025 three countries joined Sweden, UK, Czechia) plus France and Latvia join via collaborating organizations, so now 9 members and 2 collaborating organizations.
- Original (1995 and earlier) annual fee of 95 k€/yr increased for 2026 to 98.8 k€/yr (+4% max increase without unanimity) – further annual increases expected. Also, additional expected one-off payments for new correlator and receiver component redesign of 20 k€ – 50 k€ expected in next years, Annual land rental is 270k kkr/yr increasing 6%/year or by inflation if larger, agreement to 2035 but can be terminated by OSO earlier if notice given three years in advance. Power 80 kkr/yr and data connection cost < 70 kkr/yr.
- For 2026 in current agreement with VR the increase beyond 95 k€ annual fee will be implemented as a reduction of money that OSO gets. Not clear what happens 2027 onward, VR represents Sweden on LOFAR-ERIC but Chalmers agreement with VR going into LOFAR-ERIC was that Chalmers (i.e. OSO) covered any costs above 95 k€/yr for first 5 years, but while in 2026 mechanism for transferring ERIC costs to OSO exists, this mechanism does not exist for 2027 onward.
- OSO does not have any resources to support LOFAR 2.0 data storage or compute, next chance to request to VR is 2029 (for funding starting in 2031).
- Design project (DANTE) to create dual beam HBA for Space Weather application (which OSO has paid 1 Mkr toward) may be too expensive to implement. OSO does not plan to give additional funding for next detailed design phase, was not in VR proposal.
- OSO needs to work for increased Swedish science use of LOFAR
- Initial 5-year LOFAR-ERIC agreement runs till 19 Dec 2028 (i.e. covering two more full years 2027 and 2028) so new 5-yr agreement need to be finalized in 2028 for the period 2029 – 2034 meaning that Swedish decisions/input to new agreement must be made before new VR proposal is submitted in Feb 2029.
- New agreement needs to balance between ambition of partners where LOFAR is their only/main activity and partners like OSO where it is one of many activities.
- JC and Daniel Snitting (VR) to attend LOFAR-ERIC council meeting in Dublin 9th/10th June.

3.9 JIVE-ERIC/EVN, Consolidation of European Radio Astronomy

EU ESFRI infrastructure map and place of Radio Astronomy ERICs/IGOs and networks

	ANALYTICAL PHYSICS	ASTRONOMY, ASTROPARTICLE PHYSICS AND SPACE SCIENCES	NUCLEAR AND PARTICLE PHYSICS
FROM: ESFRI Landscape Analysis Report 2024 © ISBN Print: 978-88-943243-4-1			
ESFRI/ ERICS	CERIC ERIC, EMFL, ELI ERIC , ESRF EBS, ESS ERIC , European XFEL, ILL	CTAO ERIC, ELT, EST, JIVE ERIC, KM3Net 2.0, LOFAR ERIC, SKAO	ELI ERIC , EuPRAXIA, ESS ERIC , FAIR, HL-LHC, ILL , SPIRAL2
Networks	e-DREAM EMFL <u>InspireProject</u> <u>Laserlab-Europe</u> LEAPS LENS RADIATE ARIE	AHEAD, APPEC ASTRONET ESCAPE Europlanet OPTICON RadioNet SOLARNET	ECFA ESCAPE NuPECC
TA/VA projects	Calipso, Calipso+ - past projects RIANA, ReMade@ARIE, NEPHEWS. Lasers4EU	ACME, + past projects AHEAD, Europlanet, OPTICON, ORP, RadioNet. SOLARNET	EURO-LABS, HADRON-2030, PRISMA+, RADNEXT-2030 + past project ChETEC-INFRA

- Joint Institute for Radio Astronomy (JIVE) operating institute of European VLBI Network for astro VLBI on Europe, Asia and Africa. Working as engine for SKA-VLBI.
- Above EU ESFRI infrastructure landscape in Physical sciences (note Geo-VLBI is not on map, no European organization which can join others)
- EU is pressing for consolidation including merger of ERICs (i.e. possibly JIV-ERIC and LOFAR-ERIC in future)
- Radio astronomy network Radionet being made more established with new Consortium agreement and membership fee (5k€/yr for Onsala) to pay of 1 or 2 persons funded in central office to look over EU proposals etc
- Odd situation that EVN telescope is run by **two organizations i.e.** JIVE-ERIC (runs correlator, services) and ‘EVN consortium’ for telescopes. I proposed merging them in 2018/2019 but idea was rejected. Now some movement/moment here. JC asked by several to be EVN board chair from 1st Jan 2027 (it is perceived as Sweden’s turn) – would like to be chair for **one year only** through 2027 to help negotiate a EVN/JIVE merger therefore (hopefully) be last ever EVN Board chair (a passion project for me).

3.10 EU proposals deadline 15th June

HORIZON-INFRA-2026-DEV-01-03

Individual support for evolution and long-term sustainability of pan-European RIs

- Budget: **€3–4.5M**, 80% funding, lump-sums
- Resubmission of the **CHEER** proposal
- Develop a coordinated European framework for data-driven radio astronomy infrastructures
- Enable efficient shared data services across multiple facilities
- Strengthen sustainability, collaboration & global competitiveness
- Coordination: MPIfR / UNIMAN / OCA
- Partners: Many RN partners

Links ARC, SRC nodes and LOFAR processing. Possible funding for 0.7 FTE for new person in e-commons looking at staff training/sustainability. Kelley Hess leading Task.

INFRA-TECH-01-01 — AURA

Advanced Upgrades for Radioastronomical Applications

R&D for the next generation of scientific instrumentation, tools, methods, and solutions for RI upgrades — Budget: €10M

WP2 – Receivers

OSO GARD

Sub-millimetre to centimetre receivers, connected via Fibre Photonic Transmission (FPT)

WP3 – Backends & Processing

Linked to WP2 via FPT; includes data processing with clear links to ALMA

WP4 – AI Applications

AI tools for data processing and greening of infrastructure, connected to WP2 & WP3

WP5 – Applications

OSO Geo

Radio astronomy applications drawing on WP2–4 and RADIOBLOCKS results

Proposal coordinated by **JIVE**. Complete draft expected end of April; external review (incl. RN Spokesperson) planned for **mid-May**.

JC joint work package leader for WP5 working for societal applications of radio astronomy

5.1 Space Situational Awareness – (Bistatic radar)

5.2 Space Weather – prototype beam former for LOFAR

5.3 Navigation services (Geo-VLBI) – source structure correction and dynamic scheduling

AURA has multiple links between Astro and Geo VLBI Both in WP5 and in WP3 for distributed/real-time correlation

3.11 SKA status including SRC node

- Daniel Sniiting (VR) , Lars Börjesson (Chalmers) as the Swedish Council delegates plus JC (expert advising delegation) attended recent SKA council meeting in Groningen, Netherlands, 23rd/24th March.
- Daniel stated at above Council meeting no commitment yet from Sweden to pay the requested 'Additional funds' (+9% per partner) - status uncertain.
- Likely shortfall in the total additional funds required from SKAO members which will cause delays/new down-scope on SKA capability. Present geopolitical disruptions and increased oil cost an additional unwelcome factor.
- JC also attended remotely the first day of the SRCNet Resource Board 20th /21st April. Serious shortfall in resources (especially personnel) in order for SRCNet to support science commissioning of SKA- low in 2027).
- SKAO council Committee looking into needed funding 2031+ to operate and construct AA4 (double AA*) - pause or plough-on?. Very large costs for both operations and continued construction. Note that anticipated SRCNet operations cost equal rest of array ops costs (i.e would be another 15 Mkr/yr from Sweden). No agreement yet between SKAO members on how to share cost 2031+.
- Worries on cost impact of SKA on rest of radio astronomy
- New SKA Director-General Jessica Dempsey starts next month (see photo).



New SKAO Director-General Jessica Dempsey (departed ASTRON Director (NL national radio astronomy observatory) – Starting post June 2026

3.12 Annual report to VR including user/publication statistics

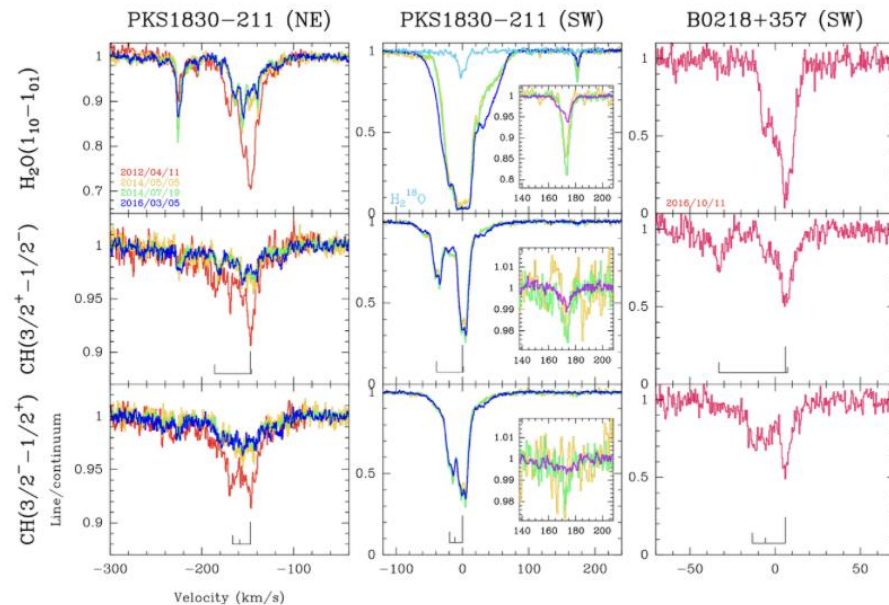
		2018	2019	2020	2021	2022	2023	2024	2025	AVG '18-'24
Infrastructure Supported papers per year with Swedish authors	ALMA/Swe	42	60	44	65	43	54	60	65	51,3
	ALMA/ARC/Swe	14	16	13	26	16	11	22	22	16,0
	ALMA/Band5/Swe	0	4	4	7	3	4	6	11	4,9
	APEX/Swe	14	12	5	15	17	9	11	12	12,0
	Astro VLBI/Swe	4	15	13	13	24	17	13	13	14,3
	LOFAR/Swe	13	11	9	9	12	8	6	9	10,3
	20m SD/Swe	1	1	2	3	4	4	4	1	2,5
	Geo/Total	4	17	8	10	4	7	7	5	8,3
	Total Infra/Swe	50	76	54	83	80	60	69	73	67,2

See separately distributed report and key statistics sent to VR 31st March – Above table shows total publications (note the 20m Single dish and Geo publications not reported to VR because these are not part of the VR contract). Note no long-form OSO annual report for 2025 produced (was taking too much effort). For information only the table's top line (ALMA/Swe) gives the total number of ALMA papers with Swedish authors (irrespective of whether these were supported by OSO via ARC or via Band 5 receiver construction).

3.13 Recent Science Results

Muller et al 2026, Astronomy & Astrophysics, 706, 365,

A sub-ppm upper limit on the cosmological variations of the fine structure constant alpha



Absorption spectra of CH and H₂O observed by ALMA toward the bright, strongly lensed quasars PKS1830-211 and B0218+357

Upper limit on the evolution of the fine-structure constant with time.
New limit a factor of 2 better than any previously published.

Recent paper using SRC node personnel with EoR experts in Switzerland/Stockholm on simulated SKA data

Implicit inference of the reionization history with higher-order statistics of the 21-cm signal

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⁷Centre for Artificial Intelligence, Zurich University of Applied Sciences (ZHAW), Technikumstrasse 71, 8400 Winterthur, Switzerland

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A millisecond localization associates FRB 20190417A with a compact persistent radio source and an extreme magneto-ionic environment

ALEXANDRA M. MOROIANU¹, SHIVANI BHANDARI², MARIA R. DROUT^{3,4}, JASON W. T. HESSELS^{5,6,1,7}, DANTÉ M. HEWITT¹, FRANZ KIRSTEN^{8,7}, BENITO MARCOTE^{9,7}, ZIGGY PLEUNIS^{1,7}, MARK P. SNELDERS^{7,1}, NAVIN SRIDHAR^{10,11}, UWE BACH¹², EMMANUEL K. BEMPONG-MANFUL^{13,14}, VLADISLAVS BEZRUKOV¹⁵, RICHARD BLAAUW⁷, JUSTIN D. BRAY¹³, SALVATORE BUTTACCIO^{16,17}, SHAMI CHATTERJEE¹⁸, ALESSANDRO CORONGIU¹⁹, ROMAN FEILER²⁰, B. M. GAENSLER^{21,4,3}, MARCIN P. GAWROŃSKI²⁰, MARCELLO GIROLETTI¹⁷, ADAEZE L. IBIK^{3,4}, RAMESH KARUPPUSAMY¹², MATTIAS LAZDA^{3,4}, CALVIN LEUNG^{22,23}, MICHAEL LINDQVIST⁸, KIYOSHI W. MASUI^{24,25}, DANIELE MICHILLI²⁶, KENZIE NIMMO²⁴, OMAR S. OULD-BOUKATTINE^{7,1}, AYUSH PANDHI^{3,4}, ZSOLT PARAGI⁹, AARON B. PEARLMAN^{5,6}, WERONIKA PUCHALSKA²⁰, PAUL SCHOLZ^{27,4}, KAITLYN SHIN²⁸, JURJEN J. SLUMAN⁷, MATTEO TRUDU¹⁹, DAVID WILLIAMS-BALDWIN¹³, AND JUN YANG¹⁸

Fast Radio Burst (FRB) paper using 25 m telescope VLBI observation + involving Chalmers authors

4. VR Infrastructure Proposal 2027 – 2030 – Final Result

Funding proposal to VR for support of OSO's infrastructure's astronomy activities for the period 1st January 2027 – 31st December 2030.

--*Proposal submitted* - 18th February 2025 – requested **160 Mkr** from VR over four years with Chalmers offering and additional **71 Mkr** in co-funding (possible by counting two modules, i.e. SRC Node and Band 7 Receivers, as international projects and so eligible for 100% VR funding with other three modules (Management, OSO Telescopes, ARC node) being 50%/50% funded by VR and Chalmers.

--*Evaluation results* -25th September 2025, with 'Truly Outstanding' assessment and near perfect grades.

--*1st VR-OSO/Chalmers dialogue meeting* -29th October, VR offered **136 Mkr** with weak/non-existent justification and VR asking Chalmers to increase its co-funding by +24 Mkr because of the overall excellence of programme (!) .

-- *2nd Dialogue meeting* -10th December - *Written reply to questions* - 25th January.

--*Final result 2nd March 2026*, VR gives final total amount **154 Mkr** over four years. Reduction in VR's amount by -6 Mkr due to VR not needing to give its half of Triband hardware costs (-5 Mkr) plus the delay in SRC node hardware reducing ops cost (- 1 Mkr).

- Argumentation to VR that Chalmers had in effect increased its contribution by **+13 Mkr** from Hasseblad income was important in showing Chalmers had moved partly toward increased co-funding. Final amount of VR + Hasselblad funding is **167 Mkr** cf VR request - while direct Chalmers funding stays same, In end in total OSO gets **+7 Mkr** more for its activities than requested in proposal but this extra amount is expected to be absorbed in extra inflation costs.

-Final slightly adjusted budget (taking into account 3%/yr not 2%/yr inflation, additional salary increases and delay in SRC node, rollout) was sent to VR 8th May and approved. Hope to initiate hiring before summer for two receiver hires for TSG/GARD plus ARC and SRC node hires.

-Working with VR on final version of new KPI as final step before signing contract.

Scale of VR funding increase obtained

	2026 (Mkr)	2027 (Mkr)	% increase
A- VR funding to OSO	18	38	114
B- VR funding to JIV-ERIC, LOFAR-ERC, SKAO	20	21	3
C-Chalmers funding	25	26	1
D-LM funding	12	12	3
A+B - Total VR funding to Radio Astronomy	38	59	55

From 2018 – 2026 the total VR funding for radio astronomy i.e. OSO plus international subscriptions to JIV-ERIC, LOFAR-ERIC and SKAO has been fixed at 38 Mkr/yr as part of the *radio astronomy packet’- As costs for SKAO membership have increased the amount left for OSO has decreased so VR income to OSO for 2026 is only 18 Mkr. 2027 and onward all international subscriptions paid directly by VR. The new agreement with VR corresponds to a **doubling** of OSO's current VR funding **and a 55% increase in overall funding for radio astronomy (!!)**

Despite above OSO’s 2027 total real budget income considering inflation is still below the 2018 level plus there are additional costs (SRC Node etc). Reason for still tight funding since 2018 is that Chalmers funding to OSO has only increased by 0.7%/year (and LM funding only one increases +0.4 Mkr into 2026). A review was expected this year of the Chalmers funding to OSO from 2029 onward; current status of this unclear. **Review critical for future of OSO 2031 and onward, if Chalmers only continues its 0.7%/yr increase then because of matching rules OSO total astronomy budget can never increase faster than 0.7%/yr despite OSO performance.** Sustainability also requires that SRC Node and ALMA Receiver modules stay as international projects 2031 onward, **which requires GARD to win another ALMA contract after Band 7.**

In parallel we are working for increased LM funding set at 12 Mkr/yr since 2022 but increased to 12.4 Mkr for 2026 (LM put in a request to government for an increase of + 5 Mkr/yr to enable correlation, this is not for inflation correction per se, but maybe able to use some of any increase this for that in addition to extra deliverables).

Concrete result of new budget will be hiring into 2027 of 4 new FTE’s 2 in receiver area, 1 for ARC node and 1 for SRC node.

Chalmers funding to infrastructures – Rektor decision September 2025

Infrastrukturens namn	Värd- inst.	2025	2026	2027	2028	2029
Belopp i tkr. Detta beslut omfattar endast belopp i rött.						
E-commons <i>Basfinansiering till C3SE¹</i> Tillägg	F	5445 ¹ 9500	5499 ¹ 9500	9500	9500	Omtag på helhet
Myfab Chalmers (Nanotekniklaboratoriet) <i>Basfinansiering¹</i> Förnyelse, uppgradering Tilläggsbeslut 2017	MC2	25255 ¹ 4000 3000	25508 ¹ 4000 3000	4000 3000	7000	Omtag på helhet
Onsala Rymdobservatorium <i>Basfinansiering¹</i> Medfinansiering KAW Tvillingteleskop Tilläggsbeslut 2017 Fortsättning på tillägg inför omtag Radom t.o.m. 2033, C 2013-1434	SEE	21803 ¹ 2000 3000 200	22021 ¹ 3000 200	3000 200	3000 200	Omtag på helhet
SUMMA ny tilldelning i detta beslut		0	0	0	3000	
SUMMA tilldelade medel i tidigare beslut		22 550	19 700	19 700	16 700	
Kvarvarande del av reserverade medel (20 Mkr + tillägg 6 Mkr t.o.m. 2027)		3450	6300	6300	300	

¹ Rektors långsiktiga basfinansiering till e-commons, Myfab Chalmers och OSO räknas upp med 1% per år och omfattar 52 503 tkr för 2025. För enkelhets skull visar vi beloppen enbart för 2025 och 2026.

Det finns en avsikt att under 2026 följa upp verksamhets- och finansieringsnivåerna för OSO, Myfab Chalmers och e-commons och besluta om långsiktigt hållbara nivåer på basfinansiering för 2029 och framåt. I beredningen bör det ingå en analys (benchmark) av forskningsinfrastrukturens andel av omsättningen vid andra liknande organisationer. I begreppet "långsiktigt hållbara nivåer" ingår att fortsättningsvis undvika tilläggsbeslut utöver rektors basfinansiering till de tre nämnda infrastrukturerna.



There is an intention during 2026 to follow up on the operational and funding levels for OSO, Myfab Chalmers and e-commons, and to decide on long-term sustainable levels of core funding for 2029 and beyond. The preparation should include an analysis/benchmark of the research infrastructures' share of the turnover at other comparable organisations. The term "long-term sustainable levels" includes continuing to avoid supplementary decisions beyond the President's core funding for the three infrastructures mentioned.

5. Risk Register

Risk Number	Risk Name	Impact Description	Probability (1-5)	Impact scale (1-5)	Exposure (risk x probability)	Treatment plan
1	Inability to retain engineering staff due to non-competitive salaries/condtions with industry (defence boom)	May not be possible to maintain all instruments and telescopes and deliver Triband and Band 7	4	4	16	(1) Work for best conditions and salary within Chalmers system (2) Provide interesting projects, like Triband, Band 7
2	Long delays in recruiting engineering staff due to non-competative salaries/conditions with industry (defence)	Delays in delivering Triband and Band 7	3	4	12	(1) Wide advertising. (2) Seek foreign candidates (3) Provide interesting projects
3	Insufficient top leadership (min 2 FTE needed for Director, +Deputy/Assistant Director + Division head)	Critical failure mode for illness/absence. Unsustainable workloads. Decision quality affected. Missed oportunities	4	3	12	Current funding only sufficient for 1.6 FTE and current level of Directorship effort after WV departure 1.2 FTE. Seek increased Chalmers funding and recruit.
4	Insufficient unit level management effort	Causes staff HR issues, inefficiencies and extra tasks for Directorship, inability to help in fundraising etc	4	2	8	Limited pool to draw upon in of staff with needed skills who also have sufficient time to give to tasks. Hard to make jobs attractive.
5	No or insufficient Chalmers funding increase to OSO agreed beyond 0.7%/yr	Via matching rules limits VR funding to OSO 2031 and onward irrespective of OSO performance	4	5	20	Make case within Chalmers that sustainable OSO funding needed to retain OSO excellence
6	Required Very large increases for SKA central and SRCNet costs for 2031 onward	Can limit (or even reduce) VR contribution to OSO 2031 onward	3	5	15	Ensure that Swedish decisions for SKA take into account balance with mm astronomy and other cm/m telescopes (LOFAR+VLBI)
7	No inflation compensation increase in LM funding for Geoscience	Possible inability to maintain OTT as it ages. Removal of support for S/X on 20m	3	3	9	Argue case with LM to include this in requests to government
8	No LM or other funding for adding Geo correlation capacity	Reduces expansion of VGOS correlation capacity and limits VGOS accuracy	3	2	6	Make strategic case for EoP parameters et to government/funders

9	Major mechanical failure of a telescope	i.e. for 25 m telescope. Would limit science return from VLBI reducing aregument for Onsala as a working observatory	3	4	12	(1) Maintain telescopes.(2) Add C-band to 20 m telescope. (3) Seek private funding for 25 m replacement, i.e. SKA or ngVLA dish
10	Increasing Radio interference makes observiing astro or geo VLBI or LOFAR partly or completely impossible	Impact on Astro science and Geo accuracy	3	3	9	(1) Support international efforts to regulate satellite emissions. (2) Keep good national contact with PTS. (3) Monitor and suppress internal interference sources
11	GARD does not win the contract for ALMA WSU Band 7 delivery	Difficult situation because 100% funding from VR for Module 3 and financing GARD depends on this	3	4	12	(1) Do all we can to win contract (2) Most likely VR would not withdraw money and instead repurpose say for Band 9 development

Probability Key	Impact Key	Exposure key
1-Not Likely	1-Low	20 to25
2-Low Likelihood	2-Minor	15 to 19
3-Likely	3-Moderate	10 to 14
4-Highly Likely	4-Major	5 to 9
5- Near Certainty	5-Catastrophic	0- 4

6. Geo Activity

See following slides presented by Rudiger Haas

Geoscience news



- Geodetic VLBI
- VGOS correlator discussions
- ESA Genesis and NovaMoon missions
- Gravimetry
- Tide gauges
- EC Task Force on Geodetic Supply Chain
- UNGGCE report – State of Geodesy 2026
- Education

OSC meeting 2026-05-22

Geodetic VLBI

- Using both 20 m for S/X legacy and OTT for VGOS
- IVS observations 2026
 - S/X legacy 24 h: 50 sessions with On
 - VGOS 24 h: 48 / 46 sessions with Oe / Ow
 - VGOS Rapid: 10 station network, 100 TB data cap
 - VGOS Operational: 16 station network, 200 TB data cap
 - VGOS-RD: entire 22 station network, no data cap
 - VGOS-INT-B/C, 1 h:
 - 48 x 4 sessions on weekends with Oe / Ow
- New VGOS frequency setup developed: IVS resolution 2026-01
 - Weekly 1 h tests observed in spring, correlated at OSO
 - 24 h session observed 2025-05-20

IVS Resolution 2026-01

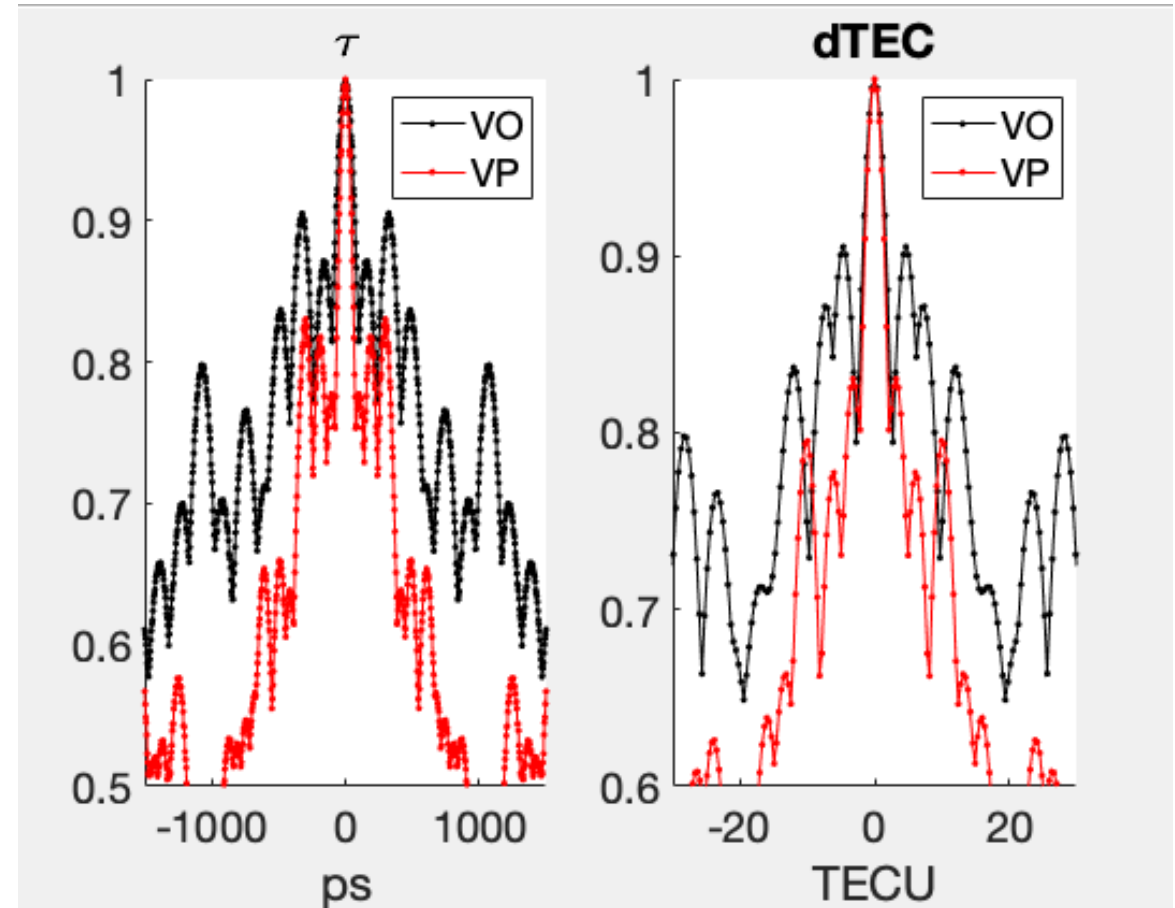
IVS Resolution 2026-01

IVS-Res-2026-01

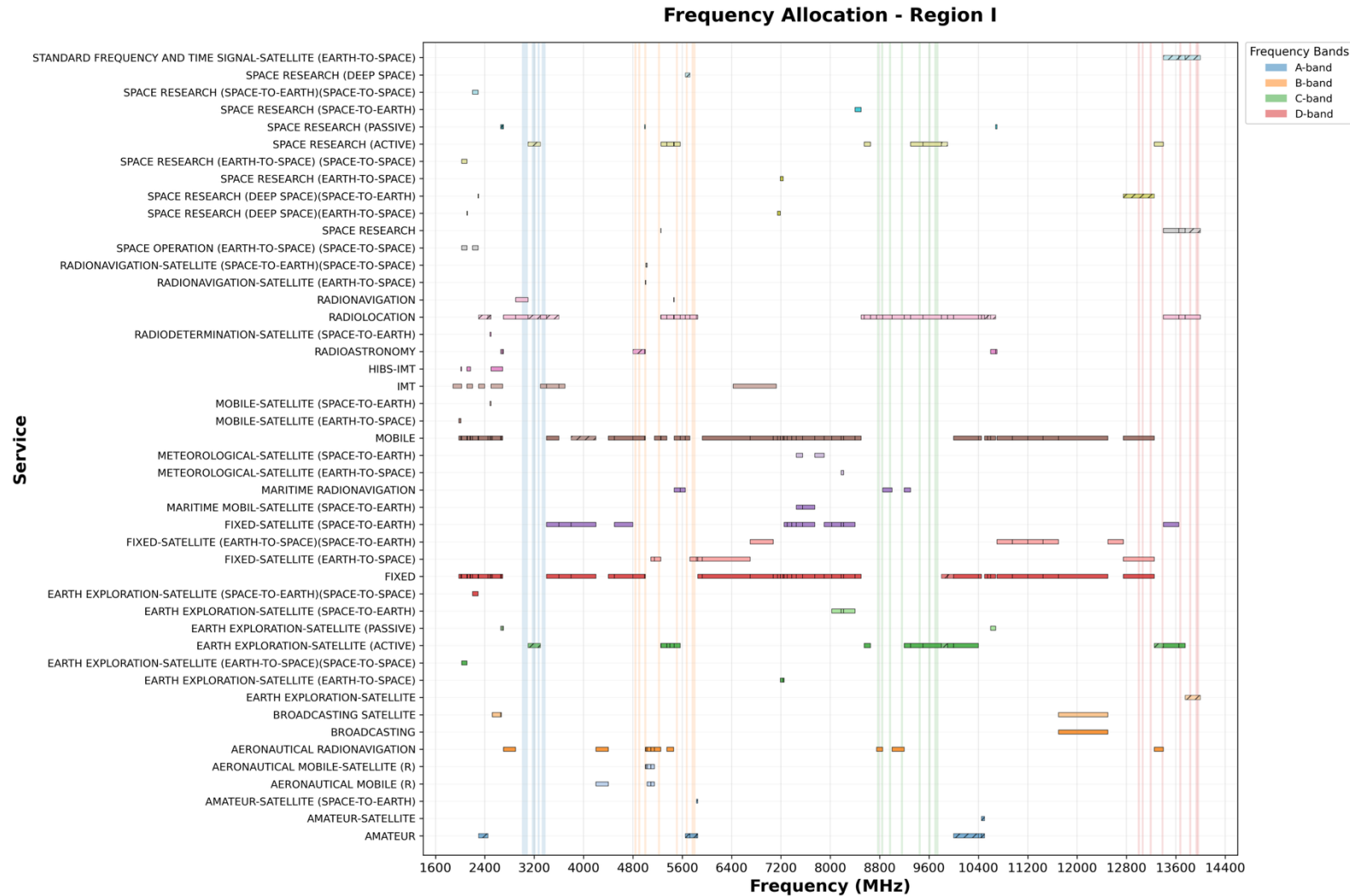
Frequency Sequence for Future VGOS Operations

The IVS Directing Board proposes using the frequency channels listed in the table below for future VGOS operations. The frequency setup consists of thirty-two channels of 32-MHz bandwidth each, organized in four frequency bands. The frequency channels may be adjusted slightly to improve geodetic products; however, there is no guarantee to obtain frequency protection by spectrum management. The IVS Directing Board further requests that IVS components providing VGOS infrastructure take appropriate steps to use these frequencies operationally by 2028 as best as they can. Caveat: In the event that a band becomes unusable for the entire station network or major parts of it, for instance due to strong RFI, an alteration to the frequency setup may become a necessity.

Frequency Channel	Band-A f_{start} (MHz)	Band-B f_{start} (MHz)	Band-C f_{start} (MHz)	Band-D f_{start} (MHz)
1	3000.4	4824.4	8760.4	12984.4
2	3032.4	4888.4	8824.4	13048.4
3	3064.4	4984.4	8952.4	13176.4
4	3160.4	5208.4	9144.4	13368.4
5	3192.4	5496.4	9432.4	13656.4
6	3256.4	5656.4	9592.4	13816.4
7	3320.4	5752.4	9688.4	13912.4
8	3352.4	5784.4	9720.4	13944.4



Frequency protection for VGOS



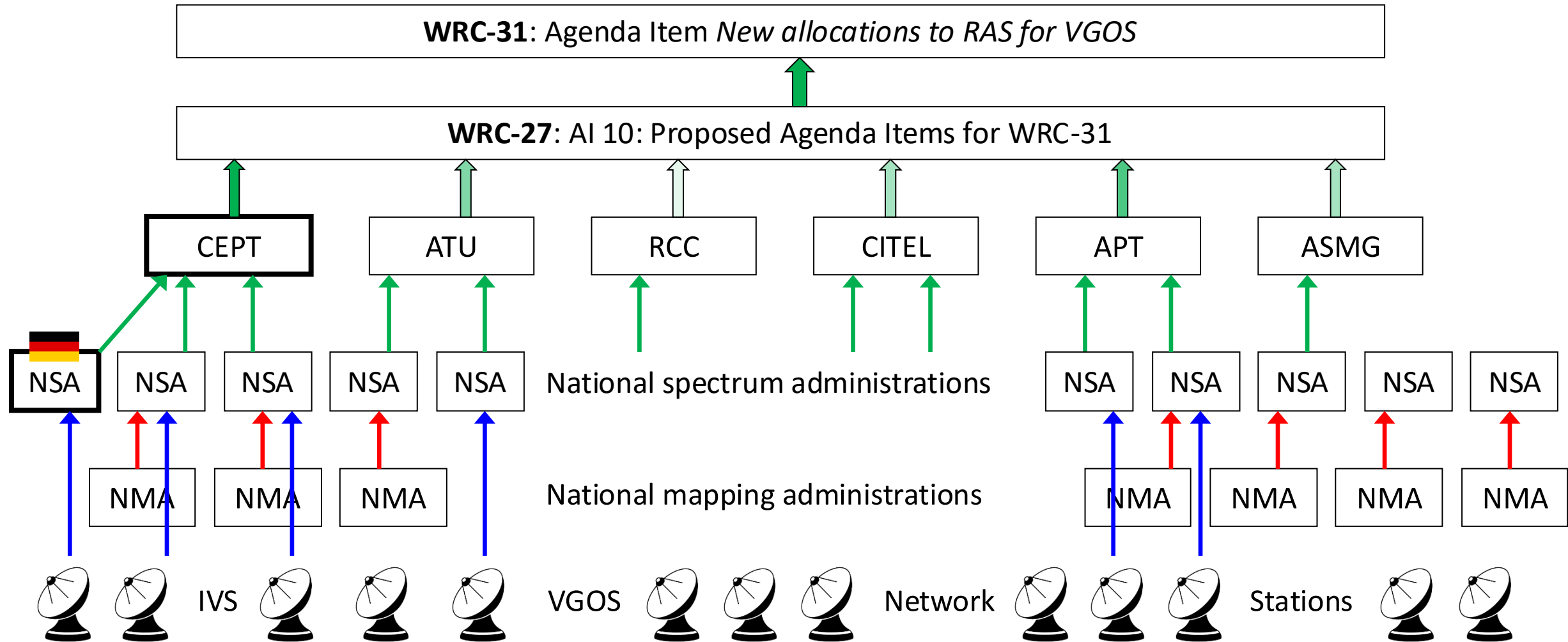
Attempt to avoid current and future frequency allocations of active ground-based and space-borne services

=> Proposal via German NSA (National Spectrum Administration) to the European level (CEPT) in March 2026

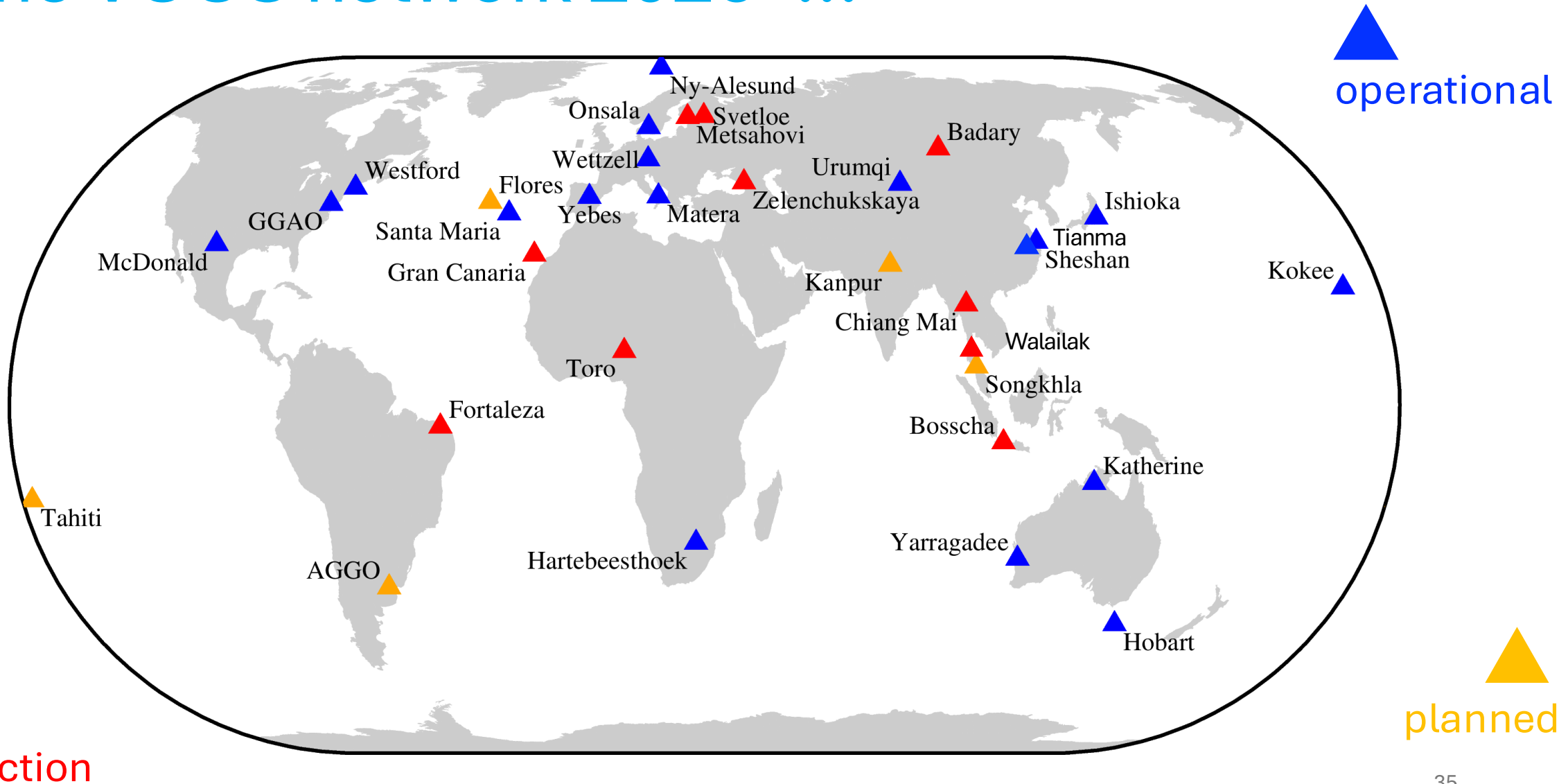
Frequency coordination / protection

- Input by Germany to the European Conference of Postal and Telecommunications Administrations (CEPT) in March 2026
 - Positive reactions from, e.g., SWE, NOR, FIN, POR, FRA, also ESA
 - But also negative reactions from, e.g., LUX
 - Next CEPT in September to decide on input for WRC-27
- UN-GGIM subcommittee Geodesy Working Group "Frequency Protection"
 - Goal to achieve a WRC-31 agenda item
 - Needs support from national spectrum management agencies
 - Eurographics "Talking heads" seminar 2026-04-21 by Jeffrey Verbeugt

The path to an Agenda Item at WRC-31



The VGOS network 2026–...



IVS GM 2026



OSO-SGG well represented @ IVS GM 2026

- Alva Kinman (PhD student): oral talk
- Rimsky Wolfs (PhD student): oral talk
- Lim Chin Chuan (senior res. eng.): oral talk + two posters
- Karine Le Bail (assoc. Prof.): oral talk
- Rüdiger Haas: oral talk + poster
- Tobias Nilsson (adj. docent): oral talk

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Onsala mentioned @ IVS GM 2026

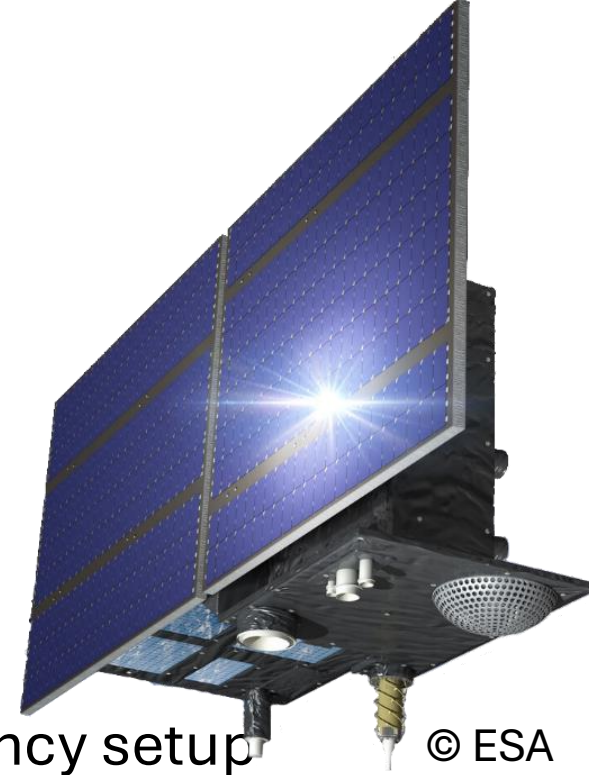
- Some statistics were presented by several contributors:
- "Onsala 20 m most reliable station in the IVS S/X legacy network."
- "Oe/Ow most contributing stations to IVS VGOS observations."

VGOS correlator discussions

- IVS is still restricted in correlator-capacity
- Initiative for Nordic VGOS correlator was not successful ☹
 - National Swedish solution (?)
- Discussions with SNSA, Lantmäteriet and Chalmers/OSO
 - SNSA aware of the importance
 - seems to have possibility to help with start-up funding
 - Discussions need to be continued
 - Plan: bi-monthly meetings SNSA-Lantmäteriet-Chalmers/OSO
 - Potential letter of support from Försvarsmakten
 - “pitch” of VLBI importance in end of February, follow-up discussion needed

ESA Genesis mission

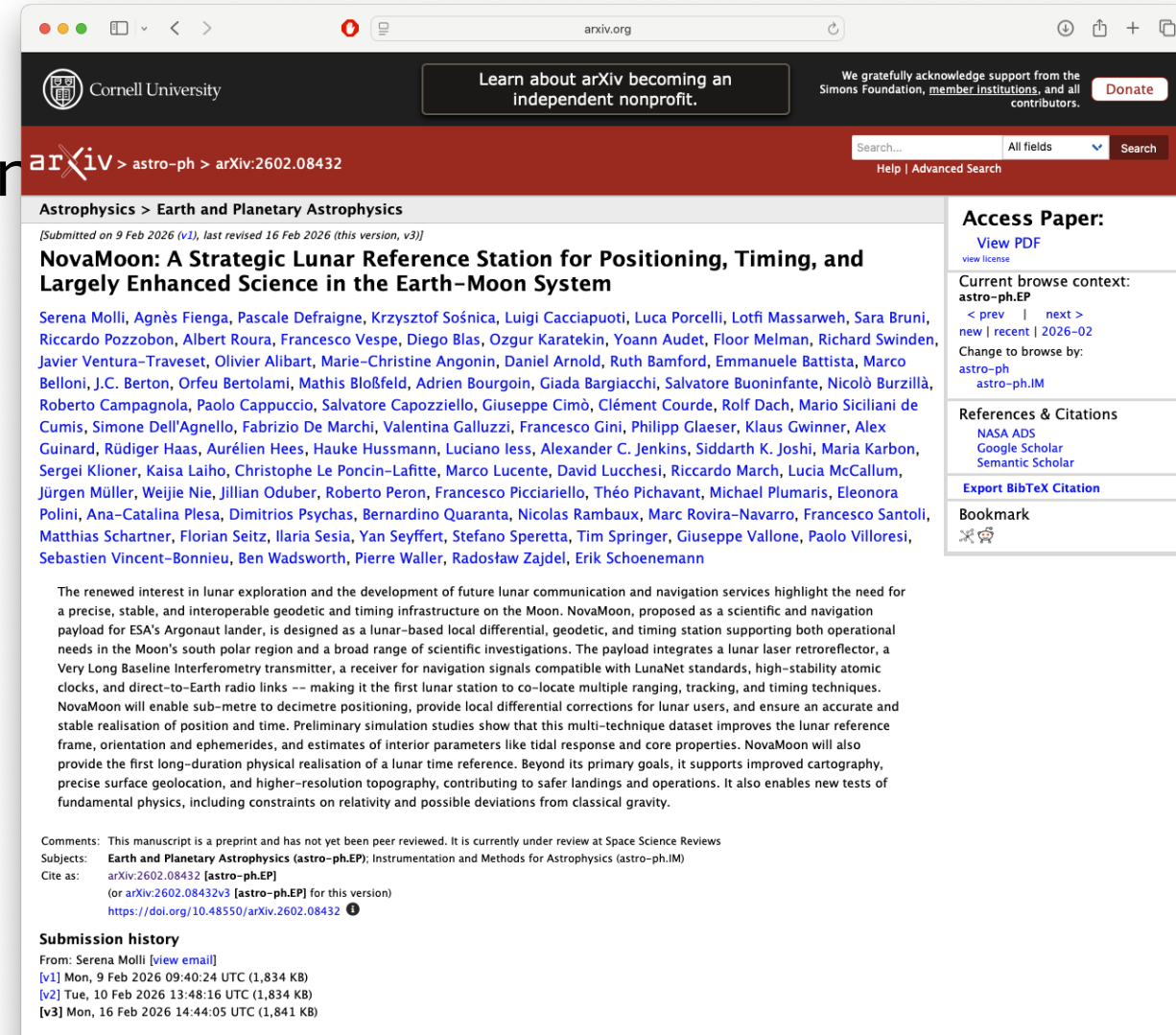
- ESA GSET WG3 (VLBI)
 - Chaired by Rüdiger Haas
 - Advise to ESA on VLBI aspects of Genesis mission
 - Big topic: handling of 3 transmit antennas
 - Successful fringe tests with possible future Genesis frequency setup
 - Three different networks
 - Correlated in Vienna/Bonn
 - First 24 h international session with Genesis frequency setup 2026-06-24



© ESA

ESA NovaMoon

- ESA VLBI transmitter on the Moon
 - Connect ITRF and ILuRF
- Part of Argonaut mission
 - Launch 2023/31
- Following the Genesis example



Gravimetry

- New colleague since mid May 2025
 - Ongoing training and hand-over phase
 - Renewal of data acquisition / storage system
- Discussions with Lantmäteriet and RISE on “Equip-G” project (European Quantum Infrastructure Project for Gravimetry <https://equip-g.eu>)
 - Goal: get a visiting quantum gravimeter to Onsala

Tide gauges

- Ongoing sea level comparison / evaluation campaign
 - Traditional tide gauge
 - GNSS-IR tide gauge
 - Swot Altimetry
- Sea surface height agreement on 3-4 cm level

EC Task Force on Geodetic Supply Chain

- Swedish delegates:
 - Tobias Nilsson (Lantmäteriet), Rüdiger Haas (Chalmers)
- Regular meetings since 2025-10-23
- Final report to EC on 2026-04-22
 - E.g., recommendations for EU-VLBI operations
 - Wait for EC response

UNGGCE report – State of Geodesy 2026



State of Geodesy 2026

A baseline maturity assessment

16 March 2026

State of Geodesy 2026: A baseline maturity assessment

United Nations Global Geodetic Centre of Excellence (2026)

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UNGGCE report – State of Geodesy 2026

6. Observations

6.1 Governance and financial capabilities as cross-cutting constraints

The overall average maturity score of 2.3 for the GGSC represents an aggregate across capabilities with highly variable performance. Within this average, the assessment identified a concentration of Level 1 scores in governance and financial management capabilities, which represent foundational functions that affect the operation of other capabilities throughout the supply chain. Specifically, the capabilities of mandate development, policy formulation, strategic planning, funding and investment, budgeting, and cost management all received Level 1 scores, indicating that these functions are largely absent or operate on an ad-hoc basis without formal structures.

The assessment identified governance as a cross-cutting constraint affecting multiple domains. No international organisation currently possesses combined visibility, authority, and accountability across the entire GGSC to develop coordinated policies, facilitate strategic resource allocation, or establish binding operational standards. The IAG coordinates scientific and technical activities effectively within its scope but operates as a scientific body without governmental authority or mandate to direct Member State actions. At the intergovernmental level, UN General Assembly resolution 69/266 represents the strongest existing mandate for geodesy, but as a non-binding resolution, it encourages voluntary action without establishing implementation mechanisms, enforcement provisions, or accountability structures.

No international organisation currently possesses combined visibility, authority, and accountability across the entire GGSC.

This absence of coordinating governance structures at the international level has implications for how critical infrastructure sectors that depend on geodetic

services ensure continuity of those services. Without an international entity responsible for overseeing supply chain resilience, coordination functions such as risk assessment, contingency planning, and strategic investment allocation occur in fragmented ways, if at all. The governance structure that exists—primarily through in-kind scientific collaboration coordinated by the IAG and periodic engagement through UN-GGIM processes—has enabled the supply chain to develop and operate, but consultation evidence suggests it has not established the strategic planning, resource coordination, or accountability mechanisms that characterise governance structures in comparable international infrastructure systems.

The governance structure that exists has enabled the supply chain to develop and operate, but has not established the strategic planning, resource coordination, or accountability mechanisms that characterise governance structures in comparable international infrastructure systems.

At the national level, consultation respondents reported that responsibility for geodesy in many countries is distributed across multiple government agencies (including those responsible for mapping, science, defence, space, and environment) without a designated lead authority or formal coordination mechanism. This organisational fragmentation creates challenges for coherent national strategy development, consistent international representation, and effective response to supply chain vulnerabilities that require cross-agency coordination. The absence of unified national coordination structures in many countries compounds the challenges of establishing effective international governance, as there may be no single national entity with comprehensive responsibility for geodesy matters.

Responsibility for geodesy in many countries is distributed across multiple government agencies without a designated lead authority or formal coordination mechanism.

The Level 1 scores in financial management capabilities reflect the absence of coordinated mechanisms for assessing funding needs, developing investment strategies, or allocating resources strategically across the supply chain. No international body currently performs systematic analysis of operational costs, capital requirements, or funding gaps across the global network of observatories, data centres, and analysis facilities. Consultation evidence indicates that funding for geodetic activities comes primarily from individual institutional budgets, with significant reliance on voluntary in-kind contributions where staff and facilities are provided by organisations without dedicated geodesy budgets. Evidence from the Global Geodesy Needs Assessment indicates that personnel at some observatories and analysis centres must seek competitive research grants to supplement operational funding, with time spent on grant applications reducing capacity for core geodetic functions.

Funding for geodetic activities comes primarily from individual institutional budgets, with significant reliance on voluntary in-kind contributions where staff and facilities are provided by organisations without dedicated geodesy budgets.

The absence of coordinated funding mechanisms has observable effects on supply chain operations. Consultation respondents reported instances where ground observatories do not consistently meet technical standards established by IAG Services, where personnel contribute time to critical functions such as standards development outside their formal work responsibilities, and where academic staff working on geodetic analysis or software development operate

under short-term contracts that create uncertainty about long-term capability continuity. The assessment identified aging infrastructure at multiple observatories without clear funding pathways for modernisation, reliance on individual software developers without institutional sustainability plans, and declining numbers of higher education programs training new geodesists—all of which respondents connected to resource constraints and absence of strategic funding coordination.

These observations suggest that while the GGSC operates and produces geodetic products that support numerous applications, the foundational capabilities required for strategic planning, coordinated investment, and systematic risk management remain underdeveloped. The current operational performance reflects the technical expertise and institutional commitment of participating organisations but occurs without the governance and financial coordination structures that would typically support long-term sustainability and resilience in systems of comparable societal importance.

6.2 Governance constraints and associated capability patterns

The assessment identified patterns where capabilities in risk management, workforce development, infrastructure resilience, and stakeholder engagement scored at lower maturity levels, with consultation evidence suggesting connections to the governance constraints described in Section 6.1.

Risk and continuity management capabilities received scores reflecting limited organisational development. Formal risk management scored 1.0, disaster recovery planning scored 1.7, and performance management scored 2.0. Consultation respondents indicated that no international organisation currently conducts systematic risk assessment, maintains comprehensive continuity plans, or monitors performance metrics across the entire supply chain. Individual IAG Services and observatories manage risks within their operational scope, but end-to-end supply chain risk visibility and coordinated contingency planning remain limited. The assessment identified several concentration points where disruption to single facilities or small numbers of personnel would significantly affect product availability. For example, the NASA Crustal Dynamics Data Information System (CDDIS) serves as the most comprehensive archive for multiple geodetic datasets,

UNGGCE report – State of Geodesy 2026

though other data centres maintain partial archives. Similar dependencies exist in product generation, where specific analysis centres produce particular geodetic products without fully redundant backup facilities. Consultation evidence indicates that formal disaster recovery protocols and geographic redundancy arrangements are not systematically implemented across data centres and analysis facilities. Additionally, limited coordinated strategies exist to address potential extended outages at critical observatories, particularly those in the southern hemisphere where station density is already lower than in northern latitudes.

Specific analysis centres produce particular geodetic products without fully redundant backup facilities.

Workforce and knowledge management capabilities also received lower maturity scores, with consultation evidence indicating challenges in both developed and developing countries. The assessment of training and education capability (score 1.7) reflected reports from multiple regions of declining numbers of university geodesy programs, reduced formal training opportunities, and an aging workforce without proportional replacement by new professionals entering the field. Consultation respondents from academic institutions noted that geodesy courses are increasingly difficult to sustain under current university operating models, and that specialised expertise in certain geodetic techniques is concentrated among small numbers of individuals approaching retirement age. The knowledge management capability scored 1.3, with evidence indicating limited systematic documentation of specialised procedures, absence of centralised repositories for technical knowledge, and dependencies on individual experts for specific software tools and analysis workflows. These patterns suggest challenges in maintaining and transferring institutional knowledge across generations of practitioners, though the extent and geographic distribution of these challenges vary across different geodetic techniques and regions.

Public and policy awareness received the lowest scores in the Engagement and Collaboration domain. The outreach and public awareness capability scored 1.3, reflecting minimal personnel capacity dedicated to this function, absence of coordinated outreach

platforms, and limited systematic efforts to communicate geodesy's role to non-technical audiences. Consultation respondents consistently reported that geodesy remains unfamiliar to most policymakers and the public, with few evidence-based materials available that explain geodesy's connections to everyday technologies and critical infrastructure in policy-relevant terms. Respondents from adjacent scientific disciplines noted limited awareness of dependencies on geodetic reference frames and products. The assessment identified this awareness gap as a structural constraint, as strategic planning and resource allocation decisions for infrastructure typically require understanding among decision-makers of the infrastructure's function and importance. Without mechanisms to systematically communicate geodesy's role, consultation evidence suggests that geodetic requirements may not be adequately represented in relevant policy processes, funding decisions, or critical infrastructure planning.

These patterns across risk management, workforce development, continuity planning, and stakeholder engagement capabilities share a common characteristic: they represent coordinating and strategic functions that typically require organisational structures with supply chain-wide visibility and convening authority. The assessment found that while individual organisations and IAG Services manage these functions effectively within their operational scope, coordinated approaches at the supply chain level remain limited, consistent with the governance and strategic planning capability assessments described in Section 6.1.

6.3 The role of the International Association of Geodesy

The assessment identified the IAG as providing essential coordination for scientific and technical functions within the GGSC. Scientists participating in IAG Service structures collaborate effectively to coordinate observations, share data, develop analysis methods, and generate geodetic products. The assessment found that IAG Services have established well-defined technical processes and procedural frameworks that enable this coordination. IAG-affiliated ground observatories demonstrated strong compliance (score 3.0) with applicable laws, regulations, and technical standards in their respective host countries. The assessment also found strong capabilities for equipment calibration and maintenance at IAG-affiliated facilities, reflecting both

technical expertise among personnel and established procedural frameworks for maintaining measurement accuracy.

Current operations depend substantially on the IAG's scientific coordination role while lacking complementary governmental coordination mechanisms that could address strategic planning, resource allocation, and policy implementation functions.

The IAG's coordination role operates within the scope of a scientific membership organisation, facilitating voluntary collaboration among researchers and institutions that contribute observatories, data centres, analysis facilities, and expertise to the supply chain. This model has enabled the development and operation of the geodetic techniques and product generation capabilities that currently support numerous applications. However, as a scientific body, the IAG operates without governmental authority to direct Member State actions, mandate resource contributions, establish binding operational requirements, or enforce compliance with standards beyond its member institutions. The effectiveness of IAG coordination in scientific and technical domains, combined with the governance capability scores described in Section 6.1, suggests that current supply chain operations depend substantially on the IAG's scientific coordination role while lacking complementary governmental coordination mechanisms that could address strategic planning, resource allocation, and policy implementation functions.

6.4 Interpretation of Assessment Findings

The maturity assessment documented a GGSC that currently operates and produces geodetic products supporting numerous applications, while exhibiting lower maturity levels in governance, strategic planning, financial management, and several coordination functions. The assessment found an average maturity score of 2.3 across all capabilities, with significant variation

across domains (ranging from 1.8 to 2.7) and even greater variation among individual capabilities (ranging from 1.0 to 4.0).

This variation in maturity scores reflects the supply chain's historical development through voluntary scientific collaboration coordinated by the IAG, which has produced strong technical capabilities and established operational procedures within individual geodetic technique communities. The assessment found well-developed capabilities in areas such as GNSS and DORIS data acquisition (scores 3.5 and 4.0 respectively), data processing and analysis for established techniques (scores generally 2.8 to 3.8), and equipment calibration and maintenance (score 3.3). These operational and technical capabilities function effectively within current resource constraints.

The lower maturity scores concentrated in governance, strategic planning, financial management, risk management, and supply chain-wide coordination capabilities (multiple Level 1 scores) indicate that functions requiring authority, accountability, and resources at the international supply chain level remain largely undeveloped. The assessment found that strategic planning, resource allocation, risk assessment, and coordination decisions occur in fragmented ways through individual institutions and voluntary collaboration rather than through formal governance structures with supply chain-wide visibility and authority.

The assessment documented several structural characteristics that may affect long-term supply chain sustainability:

- **Resource models:** Significant reliance on voluntary in-kind contributions, with personnel and facilities provided by institutions without dedicated geodesy budgets, and evidence of staff seeking competitive grants to supplement operational funding.
- **Infrastructure condition:** Consultation evidence indicating that over half of VLBI and SLR stations are aging or experiencing degradation, with uncertain funding pathways for modernisation or replacement.
- **Workforce trends:** Reports from multiple regions of declining university geodesy programs, reduced training opportunities, and concentration of specialised expertise among personnel approaching retirement age.

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7. Recommendations for Further Investigation

This assessment identified several areas where available evidence was insufficient to support confident maturity assessments, where consultation participants expressed divergent views, or where systematic data collection has not yet occurred. These areas represent priority topics for future investigation to support more comprehensive understanding of the GGSC.

7.1 Supply chain architecture and requirements definition

The assessment found no comprehensive technical specification defining the optimal configuration of the GGSC. While individual IAG Services maintain requirements for their respective techniques, no integrated analysis documents the number, geographic distribution, technical specifications, and redundancy arrangements of observatories, data centres, and analysis facilities needed to reliably produce geodetic products meeting current and projected user requirements. This gap extends to several specific questions:

- **Observatory network design:** What constitutes adequate global coverage, station density, and geographic redundancy for each geodetic technique (GNSS, VLBI, SLR, DORIS) to achieve required product accuracy and reliability? What are the minimum network configurations that will maintain acceptable product quality if individual stations experience extended outages?
- **Data centre architecture:** How many data centres with what geographic distribution and redundancy arrangements are required to ensure data availability, integrity, and preservation? What standards for synchronisation, replication, backup, and disaster recovery should apply?
- **Analysis capacity requirements:** What analysis centre capacity, distribution, and backup arrangements are needed to maintain continuous product generation? How should analysis functions be distributed to ensure resilience against institutional disruptions or geopolitical access restrictions?

- **Performance metrics and thresholds:** What quantitative accuracy, latency, availability, and reliability requirements do different user communities have for geodetic products? How do current supply chain capabilities compare to these requirements, and where do gaps exist?

No comprehensive technical specification exists defining the optimal configuration of the GGSC.

Further investigation in this area would establish technical baselines against which current capabilities and future investment decisions could be evaluated. This work would require engagement with both the geodetic community to assess technical requirements and user communities to document application-specific needs.

7.2 Security requirements and critical infrastructure classification

The assessment assigned maturity scores of 3.0 for both physical security management and cyber security management at geodetic facilities, but confidence in these assessments was noted as low. Consultation participants indicated that existing security measures appear adequate for current operations under present institutional arrangements, but systematic evaluation has not been conducted to determine whether security measures align with the strategic importance of geodetic infrastructure to critical services.

Several specific questions require investigation:

- **Current security baseline:** What physical security measures (access control, perimeter protection, surveillance, personnel vetting) are currently implemented at geodetic observatories, data centres, and analysis facilities? How do these measures vary across institutions, countries, and facility types?

about long-term sustainability and compliance with contemporary software engineering standards.

Specific investigation areas include:

- **Software inventory and dependencies:** What software tools are critical for geodetic data processing, analysis, and product generation? Which of these are proprietary versus open source? What dependencies exist between different software tools and versions?
- **Development and maintenance models:** Who develops and maintains critical geodetic software? Are development activities supported through formal institutional commitments, or do they rely on individual contributions? What succession planning exists for software maintained by individuals approaching retirement?
- **Code quality and standards:** Do geodetic software tools comply with contemporary software engineering standards for code quality, testing, documentation, and version control? Have security audits been conducted? Are software development practices consistent with those used in other critical infrastructure applications?
- **Security vulnerabilities:** Have geodetic software tools been assessed for security vulnerabilities, including input validation, access control, cryptographic implementations, and dependency vulnerabilities? Are security updates applied systematically?
- **Documentation adequacy:** Is documentation sufficient to enable new users to operate software effectively and new developers to maintain and extend codebases? Is documentation kept current as software evolves?
- **Data centre IT security standards:** Do geodetic data centres implement standardised IT security practices, including network segmentation, access controls, logging and monitoring, patch management, and incident response? Are these practices audited regularly?

Investigation in this area would require software engineering and cyber security expertise to conduct code reviews, security assessments, and documentation evaluations. Findings would inform development of software quality and security standards appropriate for geodetic infrastructure.

7.5 Quantitative workforce trends

The assessment noted consultation evidence of declining geodesy programs and aging workforce, but systematic quantitative data does not exist to characterise workforce trends comprehensively. Further investigation should establish:

- **Academic program trends:** How many universities globally offer geodesy degree programs at undergraduate, masters, and doctoral levels? How have these numbers changed over the past 10, 20, and 30 years? What are projected trends?
- **Enrolment and graduation rates:** How many students enrol in and complete geodesy programs annually? What are trends in student interest, and how do geodesy programs compare to related geoscience disciplines?
- **Workforce demographics:** What is the age distribution of professionals working in geodetic research, education, and operations? What is the expected rate of retirement over the next 5, 10, and 15 years?
- **Skill gaps and specialisations:** Which specialised skills (e.g., VLBI correlation, geoid modelling, reference frame computation) show the most acute personnel shortages? Where are these shortages geographically concentrated?
- **Career pathways:** What career pathways exist for geodesy professionals? How competitive are geodesy positions compared to adjacent fields? What factors influence career choices among students considering geodesy?

Specialised expertise is concentrated among individuals approaching retirement age.

Systematic data collection through surveys, institutional records, and labour market analysis would support evidence-based workforce planning and inform educational capacity development strategies.

7.6 Economic analysis

The assessment identified funding as inadequate (maturity score 1.0) but did not quantify current investment levels or estimate required resources. Economic analysis should address:

- **Current global investment:** What is the total annual expenditure on geodetic observatories, data centres, analysis facilities, and coordination activities globally? How is this investment distributed across countries, institutions, and functions?
- **Full cost accounting:** What are the actual costs of operating the GGSC when in-kind contributions are quantified at market value? What are the opportunity costs of relying on voluntary contributions?
- **Investment gaps:** What additional investment would be required to address identified infrastructure deficiencies, implement redundancy and security improvements, and support workforce development? What are the costs of different improvement scenarios?
- **Economic value and return on investment:** What is the economic value generated by geodetic services across different application sectors (positioning services, Earth observation, critical infrastructure timing, scientific research)? How does this compare to investment in geodetic infrastructure?
- **Cost of disruption:** What would be the economic costs of degraded geodetic service accuracy, extended outages, or supply chain failures? How do these costs compare to investment in resilience improvements?

Current investment levels are unknown, required resources are unquantified, and cost-benefit comparisons have not been performed.

Economic analysis would provide evidence for resource allocation decisions and support cost-benefit evaluation of alternative investment strategies.

Education

- Chalmers dissolves all existing MSc programmes
- 2027: 30 new MSc programmes
 - => NewSpace Systems Engineering
 - Specialisation on "Space Geodesy and Remote Sensing"
- ERASMUS+ collaboration in geodesy education on European level
 - Chalmers, ETH Zürich, TU Delft, Politecnico di Milano
 - Goal: start 2027
 - Next meeting 2026-06-19

Göteborgs-Posten Nyheter Göteborg Sport Ekonomi Ledare Kultur Debatt Poddar



Chalmers i Göteborg har runt 11 000 studenter. Förra året tog cirka 1500 av dem en masterexamen. Inför höstterminen 2027 skrotas nu alla befintliga masterprogram för civilingenjörer – och utbildningssystemet görs om. Bild: Adam Ihse/TT

Den här artikeln kan bara du som prenumererar läsa.

Chalmers skrotar samtliga masterprogram – nya skapas

Göteborg • Chalmers skrotar samtliga nuvarande masterprogram. I stället satsar lärosätet hösten 2027 på ett helt nytt programutbud. – Vi inser att vi måste göra på ett annat sätt för att hänga med, säger Chalmers vicerektor för utbildning Jörgen Blennow.

Text: Maria Domellöf-Wik
Uppdaterad: idag 14:36 | Publicerad: 2026-05-16

Dela Spara



Questions?

7. Next OSO Director and draft advert

- Closed session (OSC members only)
- See forwarded draft advert

8. Budget result 2025

The 2025 result was quite different from last year submitted budget but is close to prognosis given at the October OSC meeting.

Biggest difference to budget is absence of three budgeted FTEs. A TSG unit member left at beginning of 2025, another budgeted recruitment for a TSG to replace a person who left in 2024 was postponed till after we got the VR result. Finally, a postdoc recruitment for SGG was not completed (person took another job),

Spending on hardware was also less than budgeted. Partly because TSG was too short-staffed and busy to order equipment; plus it was decided to delay some purchases and services till after the VR result.

The apparent large capital surplus built up is needed to buffer expected against expected large 2026 operating losses and for future depreciations costs (see next slides)

[illegible]

9. Budget Prognosis 2026

Expect large loss in 2026 due to low income from VR (reduced by SKA subscription reaching its max level of 1.5 M€/yr paid by VR directly for first time in 2026 and so removed from money given to OSO in 2026).

Also 2026 is last year of OTT depreciation and unlike previous years OSO does not get any CTH OTT income.

Prognosis shows however that final result less negative than expected due to using residual SKA construction money for salary, person leaving and unexpected increase of 400 kkr in LM income.

[illegible]

10. **2027 budget** -Capital, Long term financial prognosis.

- Made start on draft 2027 budget already. Need to establish new cost structure for budgeting/reporting using the new Modules (and make unique module-unit categories for ease of budget management). Work with incoming financial officer.
- A lot of uncertainty however given that the 'Faculty model' that applies (i.e. how much money incoming to the Department for its number of faculty positions gets forwarded to Divisions and reaches individual faculty is not yet clear. SEE historically forwarded most of this money but Physics retained more centrally).
- Other uncertainties for new Department are its Overhead Percentage (likely similar to SEE but not yet finally defined) and possible salary cost increases because of new grade of 'Staff Scientist' positions

10. 2027 budget -**Capital**, Long term financial prognosis.

Updated Capital Allocations

Large purchases/construction projects taken on OSO Chalmers funding are paid for via annual depreciations **which start when equipment comes into operation**, meanwhile Chalmers supplies the liquidity.

Changes for information (investment decisions to made at October OSC meeting,

Move to Ongoing Depreciations – cost of our CNC machine in workshop, now that it is installed and working.

Move to Possible future costs – the OSO cost share (50% i.e 1Mkr) of a small building to replace current hut housing radiometers and to also house IR atmospheric spectrometer currently in container. **Investment TBD at October OSC**

Move to Possible future costs – H-maser. Current guess is an order of a new Hydrogen maser not needed because, (1) RISE ongoing application of money to buy a maser and site at Onsala, (2) Possible route to refilling of Hydrogen for our newer Russian H –maser. (3) Soon do test of time distribution from RISE. (4) Working on agreement for RISE to loan a maser in case of failure of our functioning Russian maser.

Total cost estimate for H-maser if ordered estimated to be 6 Mkr compared to earlier estimates of 4.5 – 5 Mkr

OSO Infrastructure Depreciation costs				
Ongoing Depreciations				
Activity	Amount to pay from May 2026	Total Cost	Begin Dep	End Dep
OTT telescope	3 700	33 000	2017-03	2027-02
OTT Diesel generator	33	220	2022-09	2027-02
Network Analyser TSG	788	1 100	2025-01	2029-12
Spectrum Analyser TSG	860	1 200	2025-01	2029-12
Spectrum Analyser GARD	860	1 200	2025-01	2029-12
CNC machine, OSO mechanical workshop	2 700	2 700	2026-07	2031-06
(A) Committed capital spending	8 941	6 420		
Decided future Depreciations				
	Amount to pay from May 2026	Total Cost	Start Dep	End Dep
Electric Vehicle	400	400	2026-09	2031-08
Hybrid wagon	500	500	2026-09	2031-08
Computer Server for Staff scientists	550	550	2026-10	2031-05
Upgraded ALMA Band 7 receiver	1 400	1 400	2026-10	2031-09
Additional investment 1 Mkr 2028	1 000	1 000	2028-01	2032-01
(B) Total Future Planned Investments	3 850			
Possible future Investments				
	Amount to pay from May 2026	Total Cost	Start Dep	End Dep
Hydrogen Maser (assume Geo pays 1.3Mkr) so cost 4.5-1.3 = 3.2 Mkr	4 700	0	2028-01	2032-12
New radiometer building	1 000	1 000	2027-06	2032-05
(C) Total Future Possible Investments	5 700			
Summary				
	Amount to pay from May 2026			
(D) Total committed and Planned future investments (=A+B)	12 791			

10. 2027 budget -Capital, Long term financial prognosis.

Prognosis based on final VR result and assuming 3%/yr inflation plus one-off 5% additional salary increases for staff scientist positions in 2027. Increase in FTE count to 2027 reflect 4.3 FTE hires plus one person returning from parent leave. Assumes current 'faculty model' and same OH as now, but this is not yet known in the new department.

Assume no investment in H-maser (6Mkr) or radiometer building (1Mkr) investment. Also assumes no other major investment. Despite above positive assumptions the final value of saved capital in 2030 (less future depreciation costs) is only 12.7 Mkr which is below minimum needed for emergency repairs (15Mkr).

Finally note budget is based on a 'self-limited' VR proposal in February 2025 (not full needs) in which number of FTE requested in national modules had to be capped due to the amount of Chalmers matching funding available. For standard reliable operations and management at least an additional 2 FTE or 3 Mkr/yr is required to address personnel attrition since 2018.

Must work for increased Chalmers base funding (and increased LM funding) to address above issues and allow for a VR proposal in 2029 that gives sufficient funding for sustainability into 2030's.

OSO Income - RA + Geodesy		2024	2025	2026	2027	2028	2029	2030	2031	2027-2030
VR to OSO ('26 remove SKA cost)		36,5	35,8	17,4	38,2	38,2	38,8	38,8	42,6	153,80
Chalmers total income (incl OTT comp before '26)		27,2	27,2	25,4	25,6	25,9	26,1	26,3	26,5	
Hasselblad Income		0,0	0,0	0,0	1,0	1,0	11,1	0,0	0,0	
Lantmateriet		12,0	12,0	12,0	12,4	12,4	12,4	12,4	14,0	
External Project Income (paying permanent salaries+ SRC hardware costs 2025)		4,3	10,8	0,4	0,5	0,5	0,5	0,5	0,5	
(A) Total Income to OSO for RA + Geo		80,0	85,9	55,3	77,7	77,9	88,9	78,0	83,7	
OSO Costs - RA + Geodesy		2024	2025	2026	2027	2028	2029	2030	2031	2027-2030
OSO infra permanent FTE		35,2	35,0	35,0	40,3	40,8	40,4	40,2	40,3	
Salary Cost		49,5	52,1	51,9	61,5	63,8	64,8	66,0	66,0	
OSO Internal costs (rent, elec, travel, ops. Equipment)		11,0	9,2	12,2	10,7	10,9	11,1	11,3	11,5	
Intl fees (SKA, LOFAR, APEX, ESF)		13,7	18,0	1,0	0,3	0,8	0,3	0,3	0,3	
Depreciation Costs (incl OTT)		3,3	4,0	4,6	2,0	1,9	1,9	1,3	0,6	7,0
SRC node hardware ioperating costs		0,2	0,3	0,5	0,5	0,5	1,0	1,0	2,0	
New SRC/ARC computer hardware investment		0,0	6,1	0,0	0,0	0,0	7,6	0,0	0,0	
Triband hardware investment		0,0	0,0	0,0	0,0	0,0	10,0	0,0	0,0	
New CX -band receiver investment		0,0	0,0	0,0	0,0	0,0	3,9	0,0	0,0	
(B) OSO total costs for RA + Geo		77,7	89,6	70,2	75,0	77,8	100,6	80,0	80,5	
		2024	2025	2026	2027	2028	2029	2030	2031	2027-2030
(C) Total annual result(A-B) - incl Dep costs		2,290	-3,7	-14,9	2,8	0,1	-11,7	-2,0	3,2	-10,8
Operating Result - adjusted for Dep Cost		5,639	0,3	-10,3	4,7	2,0	-9,8	-0,7	3,8	-3,8
(D) Saved capital and Reserved Amounts/Debts										
CTH saved capital at EoY		35,4	31,6	24,3	27,1	27,2	15,5	13,5	16,7	
Future committed depreciations		16,5	12,4	7,8	5,9	4,0	2,1	0,8	0,2	
CTH saved capital at EoY less future dep		18,9	19,2	16,5	21,2	23,2	13,4	12,7	16,5	

11. AoB and Next Meeting